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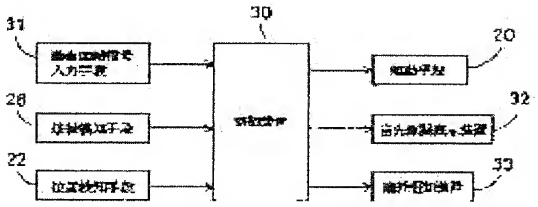
(54) DEVICE AND METHOD FOR ADJUSTING NOSE GAP OF CRUSHER

(57)Abstract:
PROBLEM TO BE SOLVED: To simplify calculation, to facilitate adjustment and to improve accuracy in the nose gap adjustment of a crusher having a jaw crusher, and to facilitate the alternation of a set value of the nose gap, moreover, to previously prevent a damage to the subject device due to overload.
SOLUTION: In the nose gap adjusting device of the crusher having the jaw crusher constituted by forming a crushing chamber having a V-shaped cross section by a stationary blade and a freely slidable dynamic blade and by having a jaw crusher constituted by supporting the upper end part of a jaw attached to the dynamic blade freely eccentrically movably and freely movably the lower part by the circular arc motion of the other end with one end of a freely movable toggle plate as a base point and adjusting the nose gap between the stationary blade and the dynamic blade by moving the jaw through the toggle plate, a detecting means 28 for detecting the contact of the stationary blade with the dynamic blade, a detecting means 22 for detecting an operation supporting position of the toggle plate and a control device 30 for calculating a nose gap value on the basis of the operation supporting position at contact and outputting the calculated nose gap value at the time of nose gap adjustment, are provided.



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CLAIMS

[Claim(s)]
[Claim 1] Frame (3) Formed anchor tooth (4) This anchor tooth (4) Moving teeth whose rocking faced each other and was enabled (5) The crushing room (6) of a cross-section V typeface is formed. And moving teeth (5) It is an eccentric shaft (7) about the upper limit section of the attached jaw (16). It supports to revolve possible [eccentric movement]. Jaw crasher which comes to restrain the lower part by radii movement of the other end on the basis of said end of the toggle plate (10) with which the end was attached in the toggle block (13) whose migration was enabled by the driving means (20) free [movement] (2) It has. The lower part of a jaw (16) is moved through a toggle block (13) and a toggle plate (10) by the driving means (20). Anchor tooth (4) The lower limit section (4a) and moving teeth (5) In the addendum clearance adjustment equipment of the shredding equipment which adjusts the radial clearance between the lower limit sections (5a) Anchor tooth (4) The lower limit section (4a) and moving teeth (5) A contact detection means to detect contact in the lower limit section (5a) (28), A location detection means to detect the location of the supporting point (12) of operation by the side of the end which makes the radix point of radii movement of a toggle plate (10) (22), The detecting signal from a contact detection means (28) and a location detection means (22) is inputted. It is an anchor tooth (4) on the basis of the location of the supporting point (12) of operation when said contact is detected. Moving teeth (5) Based on the geometric relation between a toggle plate (10) and the location of the supporting point (12) of operation, the radial clearance corresponding to the location of the supporting point (12) of operation is computed. Addendum clearance adjustment equipment of the shredding equipment characterized by having the control unit (30) which outputs said computed radial-clearance value at the time of addendum clearance adjustment.
[Claim 2] Addendum clearance adjustment equipment of the shredding equipment characterized by having the radial-clearance display (32) which displays the radial-clearance value which said control unit (30) computed in the addendum clearance adjustment equipment of shredding equipment according to claim 1.
[Claim 3] Frame (3) Formed anchor tooth (4) This anchor tooth (4) Moving teeth whose rocking faced each other and was enabled (5) The crushing room (6) of a cross-section V typeface is formed. Moving teeth (5) The lower limit section (5a) is moved and it is an anchor tooth (4). The lower limit section (4a) and moving teeth (5) In the addendum clearance adjustment approach of shredding equipment of adjusting the radial clearance between the lower limit sections (5a) Moving teeth (5) The lower limit section (5a) is moved and it is an anchor tooth (4). The lower limit section (4a) and moving teeth (5) The process at which the lower limit section (5a) is contacted, Moving teeth when contacting (5) The location of the lower limit section (5a) is detected. It is an anchor tooth (4) on the basis of this detection location. Moving teeth (5) Moving teeth (5) It is based on geometric relation with the location of the lower limit section (5a), and they are moving teeth (5). The process which computes the radial clearance corresponding to the location of the lower limit section (5a), The process which displays the computed radial-clearance value on a radial-clearance display (32), While an operator looks at the radial-clearance value displayed on the radial-clearance display (32), they are moving teeth

(5). When the lower limit section (5a) is moved and a desired radial clearance is reached, they are moving teeth (5). The addendum clearance adjustment approach of the shredding equipment characterized by having the process which stops migration of the lower limit section (5a).
[Claim 4] In the addendum clearance adjustment equipment of shredding equipment according to claim 1 said control unit (30) Anchor tooth (4) The lower limit section (4a) and moving teeth (5) The location of the supporting point (12) of operation detected with the location detection means (22) when contacting the lower limit section (5a) first is memorized as an initial criteria location. The difference value of the location of the supporting point (12) of operation detected with the location detection means (22) whenever the contact detection means (28) detected contact, and said memorized initial criteria location is calculated, and it is an anchor tooth (4). And moving teeth (5) Addendum clearance adjustment equipment of the shredding equipment characterized by calculating the amount of wear.
[Claim 5] In the addendum clearance adjustment equipment of shredding equipment according to claim 4 said control unit (30) It is based on said initial criteria location, and is an anchor tooth (4). And moving teeth (5) Set up beforehand the location or abrasion loss threshold value of the supporting point (12) of operation corresponding to a wear limitation, and it is memorized. Whenever a contact detection means (28) detects contact, the location of the supporting point (12) of operation detected with the location detection means (22) is compared with the location corresponding to said memorized wear limitation. Or addendum clearance adjustment equipment of the shredding equipment characterized by judging whether said calculated amount of wear was compared with said memorized abrasion loss threshold value, and the wear limitation was arrived at.
[Claim 6] When an alarm command is inputted in the addendum clearance adjustment equipment of shredding equipment according to claim 5, it is an anchor tooth (4). And moving teeth (5) The wear information equipment (33) which reports having arrived at the wear limitation is attached. Said control unit (30) is an anchor tooth (4). And moving teeth (5) Addendum clearance adjustment equipment of the shredding equipment characterized by outputting said alarm command to wear information equipment (33) when it judges that the wear limitation was arrived at.
[Claim 7] Frame (3) Formed anchor tooth (4) This anchor tooth (4) Moving teeth whose rocking faced each other and was enabled (5) The crushing room (6) of a cross-section V typeface is formed. And moving teeth (5) It is an eccentric shaft (7) about the upper limit section of the attached jaw (16). It supports to revolve possible [eccentric movement]. Jaw crasher which comes to restrain the lower part by radii movement of the other end on the basis of said end of the toggle plate (10) with which the end was attached in the toggle block (13) whose migration was enabled by the driving means (20) free [movement] (2) It has. The lower part of a jaw (16) is moved through a toggle block (13) and a toggle plate (10) by the driving means (20). Anchor tooth (4) The lower limit section (4a) and moving teeth (5) In the addendum clearance adjustment equipment of the shredding equipment which adjusts the radial clearance between the lower limit sections (5a) Anchor tooth (4) The lower limit section (4a) and moving teeth (5) A contact detection means to detect contact in the lower limit section (5a) (28), A location detection means to detect the location of the supporting point (12) of operation by the side of the end which makes the radix point of radii movement of a toggle plate (10) (22), The target radial-clearance value set up by radial-clearance setting means (36) to set up a target radial-clearance value, and the radial-clearance setting means (36) is memorized beforehand. At the time of addendum clearance adjustment, the detecting signal from a contact detection means (28) and a location detection means (22) is inputted. It is an anchor tooth (4) on the basis of the location of the supporting point (12) of operation when said contact is detected. Moving teeth (5) Based on the geometric relation between a toggle plate (10) and the location of the supporting point (12) of operation, the addendum real clearance corresponding to the location of the supporting point (12) of operation is computed. Addendum clearance adjustment equipment of the shredding equipment characterized by having the control unit (30) which always calculates the variation of this addendum real clearance value and said memorized target radial-clearance value, outputs a command signal to a driving means (20) so that said variation may become

abbreviation 0, and adjusts an addendum real clearance automatically.
[Claim 8] Addendum clearance adjustment equipment of the shredding equipment characterized by having the radial-clearance display (32) which displays the addendum real clearance value and the set-up target radial-clearance value which said control unit (30) computed in the addendum clearance adjustment equipment of shredding equipment according to claim 7.
[Claim 9] It has a moving limit detection means (23) to detect that the supporting point (12) of operation arrived at the critical range of operation beforehand set to the radial-clearance open side in the addendum clearance adjustment equipment of shredding equipment according to claim 1. A control unit (30) inputs the detecting signal from a location detection means (22) and a moving limit detection means (23). When the tolerance of a gap where the location of the supporting point (12) of operation detected with the location detection means (22) was beforehand defined during crushing is crossed, Or when it is judged that said supporting point (12) of operation arrived at the critical range of operation based on the detecting signal of a moving limit detection means (23) Actuation of the jaw crasher (2) by the eccentric shaft (7), and feeder which supplies debris-ed to a jaw crasher (2) (9) Addendum clearance adjustment equipment of the shredding equipment characterized by outputting the command signal which suspends actuation.
[Claim 10] In the addendum clearance adjustment equipment of shredding equipment according to claim 1 a control unit (30) The supporting point of operation after addendum clearance adjustment (12) is an anchor tooth (4) in the case of addendum clearance adjustment. Moving teeth (5) When it enters in the migration keepout area beforehand set up near the criteria location at the time of contact Eccentric shaft (7) Actuation of the jaw crasher (2) to twist, and/or feeder (9) Addendum clearance adjustment equipment of the shredding equipment characterized by outputting the command signal which suspends actuation.
[Claim 11] It sets to the addendum clearance adjustment equipment of shredding equipment according to claim 9 or 10, and they are two or more shredding equipment (1a, 1b--). It is arranged by the serial. debris transport device (52a) of the shredding equipment (1a) of the upstream from, when suspending the jaw crasher (2b) of the shredding equipment (1b) of the downstream which crushes in response to supply of debris, and/or said actuation of a feeder (9b) To coincidence, the jaw crasher of the shredding equipment (1a) of the upstream (2a), A feeder (9a) and debris transport device (52a) An output means to output the command signal which stops actuation of a feeder (9a) at least inside (53 54) Addendum clearance adjustment equipment of the shredding equipment characterized by having in the shredding equipment (1b) of the downstream.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the addendum clearance adjustment equipment and its adjustment approach of the shredding equipment using the jaw crasher which crushes rock, an ore, etc.
[0002]
[Description of the Prior Art] The radial clearance between the anchor tooth of a jaw crasher and moving teeth influences greatly the grain size of the crushed rock, i.e., product quality. Therefore, management of a radial clearance is very important. While controlling this radial clearance conventionally, about the equipment which emits an alarm at the time of an overload, there are some which were indicated by the patent registration No. 2570057 official report.
[0003]
[Problem(s) to be Solved by the Invention] However, there are the following troubles in the configuration indicated by the patent registration No. 2570057 official report.
1) Since it is computing on the basis of a co-ordinate basic origin, at the time of calculation of ****** of the moving teeth by wear, the calculation approach is complicated, and an operation load is applied to the processing unit of a control unit at it. Moreover, when it wears out, in case moving teeth are exchanged, in order to secure workspace, components, such as an oil hydraulic cylinder arranged near the moving teeth, may also be removed, but since the co-ordinate basic origin which serves as said criteria by this will change, it is necessary to perform alignment of a co-ordinate basic origin with a sufficient precision at the time of the addendum clearance adjustment after a parts replacement. Therefore, the addendum clearance adjustment approach becomes complicated and tuning takes time amount.
2) Since the hydraulic-pump travel which computes moving-teeth movement magnitude required in order to maintain a radial clearance to predetermined constant value, and is equivalent to this movement magnitude is calculated, the oil hydraulic cylinder for a moving-teeth drive is expanded with this hydraulic-pump travel and moving teeth are moved, is large, and the adjustment precision of a radial clearance is not sometimes good. [of the migration error under the effect of the oil spillage of these hydraulic equipment, the engine-performance error for every device, etc.]
3) It is necessary to change a radial clearance by the class of debris-ed, or the application of debris. Although it is necessary especially to change a radial clearance each time when the class of debris-ed and the application of debris change with work sites like a portable type crusher, in the case of the above-mentioned conventional technique, a radial clearance is always adjusted uniformly, therefore an application is restricted, and it is small, the applicability, i.e., versatility, of shredding equipment.
4) Since an operator's suitable treatment is only expected by the approach of emitting an alarm and making an operator corresponding at the time of an overload, human being's treatment mistake cannot be covered, but breakage of equipment may be caused when the worst.
[0004] This invention is the easy operation approach in the addendum clearance adjustment of the shredding equipment which has a jaw crasher paying attention to the above-mentioned

trouble, and makes tuning easy, and it aims at enabling it to adjust a radial clearance correctly moreover. Moreover, other purposes are being able to make a setting change of a radial clearance easily according to the class of debris-ed, the application of debris, etc. Furthermore, another purpose is being able to prevent the equipment breakage by the overload beforehand.
[0005]
[Means for Solving the Problem and its Function and Effect] In order to attain the above-mentioned purpose, he is trying to compute the radial clearance according to the location of the supporting point of operation in this invention, based on the radial-clearance property which can be found with the geometric relation between an anchor tooth, the jaw which attached moving teeth, a toggle plate, and the location of the supporting point of operation so that it may explain below. As compared with the approach of asking for a radial clearance by the distance operation to the moving-teeth lower limit section location to the co-ordinate basic origin which this prepared in the toggle block [of the supporting point of operation], and driving means side like before, an operation becomes very easy, and the addendum tuning after a moving-teeth exchange activity etc. becomes easy, and adjustment time amount is also shortened.
[0006] Namely, the 1st invention concerning this invention forms the crushing room of a cross-section V typeface with the moving teeth whose rocking faced the anchor tooth formed in the frame, and this anchor tooth, and was enabled. And the upper limit section of the jaw which attached moving teeth is supported to revolve possible [eccentric movement] with an eccentric shaft. It has the jaw crasher which comes to restrain the lower part by radii movement of the other end on the basis of said end of the toggle plate with which the end was attached in the toggle block whose migration was enabled by the driving means free [movement]. In the addendum clearance adjustment equipment of the shredding equipment which is made to move the lower part of a jaw through a toggle block and a toggle plate by the driving means, and adjusts the radial clearance between the lower limit section of an anchor tooth, and the lower limit section of moving teeth A contact detection means to detect contact in the lower limit section of an anchor tooth, and the lower limit section of moving teeth, A location detection means to detect the location of the supporting point of operation by the side of the end which makes the radix point of radii movement of a toggle plate, Input the detecting signal from a contact detection means and a location detection means, and the radial clearance corresponding to the location of the supporting point of operation is computed based on the geometric relation between an anchor tooth, moving teeth, a toggle plate, and the location of the supporting point of operation on the basis of the location of the supporting point of operation when said contact is detected. It is considering as the configuration equipped with the control unit which outputs said computed radial-clearance value at the time of addendum clearance adjustment.
[0007] According to the 1st invention, it can detect that the lower limit section of the anchor tooth of a jaw crasher and the lower limit section of moving teeth contacted with the contact detection means, a location detection means can detect the location of the supporting point of operation at that time, and the radial clearance according to the location of the supporting point of operation can be computed on the basis of this location. Thereby, while computing wear on the basis of the distance between the contact locations of a co-ordinate basic origin, said anchor tooth, and moving teeth, a complicated operation like the conventional technique of adjusting a radial clearance becomes unnecessary. Therefore, a radial-clearance value can be computed by the easy operation, and moving teeth can be moved to the location which serves as a predetermined radial clearance by this. That is, since a criteria location turns into only a supporting-point location of moving teeth when an anchor tooth and moving teeth contact of operation, it can compute a radial clearance correctly easily. therefore, a radial clearance can be changed easily -- both, the operation load of processing units, such as CPU, is mitigated and cost reduction and an equipment miniaturization can be performed.
[0008] The 2nd invention is taken as the configuration equipped with the radial-clearance display which displays the radial-clearance value which said control unit computed based on the configuration of the 1st invention.
[0009] Since the radial clearance which the control unit computed is displayed with a radial-clearance display according to the 2nd invention, an operator can check a current radial

clearance easily, therefore becomes very easy [the tuning of a radial clearance].
[0010] The 3rd invention forms the crushing room of a cross-section V typeface with the moving teeth whose rocking faced the anchor tooth formed in the frame, and this anchor tooth, and was enabled. In the addendum clearance adjustment approach of shredding equipment of moving the lower limit section of moving teeth and adjusting the radial clearance between the lower limit section of an anchor tooth, and the lower limit section of moving teeth The process at which the lower limit section of moving teeth is moved, and the lower limit section of an anchor tooth and the lower limit section of moving teeth are contacted, The process which detects the location of the lower limit section of the moving teeth when contacting, and computes the radial clearance corresponding to the location of the lower limit section of moving teeth based on geometric relation with the location of the lower limit section of an anchor tooth, moving teeth, and moving teeth on the basis of this detection location, When the process which displays the computed radial-clearance value on a radial-clearance display, and an operator move the lower limit section of moving teeth and reach a desired radial clearance, looking at the radial-clearance value displayed on the radial-clearance display, they are considering as the approach of having the process which stops migration of the lower limit section of moving teeth.
[0011] According to the 3rd invention, the lower limit section of moving teeth is moved and the radial clearance according to the lower limit section location of moving teeth is computed on the basis of the lower limit section location of moving teeth when the lower limit section of an anchor tooth and the lower limit section of moving teeth contact. Thereby, as carried out in the explanation paragraph of an operation of the 1st invention of the above, an exact radial clearance is computable by the easy operation. Moreover, the computed radial-clearance value is displayed on a radial-clearance display, and an operator can adjust a radial clearance, looking at the indicated value. Therefore, an exact radial clearance can be adjusted easily. Therefore, a quality product can be obtained.
[0012] The 4th invention is based on the configuration of the 1st invention. Said control unit The location of the supporting point of operation detected with the location detection means when contacting the lower limit section of an anchor tooth and the lower limit section of moving teeth first is memorized as an initial criteria location. Whenever a contact detection means detects contact, it is considering as the configuration which calculates the difference value of the location of the supporting point of operation detected with the location detection means, and said memorized initial criteria location, and calculates the amount of wear of an anchor tooth and moving teeth.
[0013] After exchanging an anchor tooth and/or moving teeth according to the 4th invention, the location of the supporting point of operation when contacting the lower limit section of an anchor tooth and the lower limit section of moving teeth first is memorized as an initial criteria location. Since the difference value of the location of the supporting point of operation at that time and said memorized initial criteria location is calculated and the amount of wear of an anchor tooth and moving teeth is calculated whenever it makes it contact after that, the amount of wear is measured correctly automatically, without an operator measuring the actual thing, and, therefore, prediction of the life of an addendum is attained with the amount of wear. Therefore, since life management of an anchor tooth and moving teeth can be performed correctly easily, the precision of product quality (that is, grain size) is maintainable to homogeneity.
[0014] The 5th invention is based on the configuration of the 4th invention. Said control unit Based on said initial criteria location, set up beforehand the location or abrasion loss threshold value of the supporting point of operation corresponding to the wear limitation of an anchor tooth and moving teeth, and it is memorized. Whenever a contact detection means detects contact, it judges whether the location of the supporting point of operation detected with the location detection means was compared with the location corresponding to said memorized wear limitation, or said calculated amount of wear was compared with said memorized abrasion loss threshold value, and the wear limitation was arrived at.
[0015] It judges automatically, without an operator judging whether an anchor tooth and moving teeth reached the wear limitation according to the 5th invention. Therefore, since life management of an anchor tooth and moving teeth can be performed easily correctly and

exchange of an anchor tooth or moving teeth can be performed at a suitable stage, product precision can be improved.
[0016] Based on the configuration of the 5th invention, the 6th invention attaches the wear information equipment with which an anchor tooth and moving teeth report having arrived at the wear limitation, when an alarm command is inputted, and said control unit is carrying out as the configuration which outputs said alarm command to wear information equipment, when an anchor tooth and moving teeth judge that the wear limitation was arrived at.
[0017] As for an operator, according to the 6th invention, it is intelligible whether an anchor tooth and moving teeth reached the wear limitation with information equipments (a buzzer, drop, etc.). Therefore, since it can deal with exchange of an anchor tooth or moving teeth etc. immediately, the product of good quality can be obtained.
[0018] The 7th invention forms the crushing room of a cross-section V typeface with the moving teeth whose rocking faced the anchor tooth formed in the frame, and this anchor tooth, and was enabled. And the upper limit section of the jaw which attached moving teeth is supported to revolve possible [eccentric movement] with an eccentric shaft. It has the jaw crasher which comes to restrain the lower part by radii movement of the other end on the basis of said end of the toggle plate with which the end was attached in the toggle block whose migration was enabled by the driving means free [movement]. In the addendum clearance adjustment equipment of the shredding equipment which is made to move the lower part of a jaw through a toggle block and a toggle plate by the driving means, and adjusts the radial clearance between the lower limit section of an anchor tooth, and the lower limit section of moving teeth A contact detection means to detect contact in the lower limit section of an anchor tooth, and the lower limit section of moving teeth, A location detection means to detect the location of the supporting point of operation by the side of the end which makes the radix point of radii movement of a toggle plate, The target radial-clearance value set up by radial-clearance setting means to set up a target radial-clearance value, and the radial-clearance setting means is memorized beforehand. At the time of addendum clearance adjustment, the detecting signal from a contact detection means and a location detection means is inputted. Based on the geometric relation between an anchor tooth, moving teeth, a toggle plate, and the location of the supporting point of operation, the addendum real clearance corresponding to the location of the supporting point of operation is computed on the basis of the location of the supporting point of operation when said contact is detected. The variation of this addendum real clearance value and said memorized target radial-clearance value is always calculated, and it is considering as the configuration equipped with the control unit which outputs a command signal to a driving means and adjusts an addendum real clearance automatically so that said variation may become abbreviation 0.
[0019] According to the 7th invention, the radial clearance of a jaw crasher is set as the desired value of beforehand a request, and this value is stored in a control unit. And a control unit always calculates the variation of the addendum real clearance computed based on the detecting signal of a contact detection means and a location detection means, and the target radial-clearance value which carried out [above-mentioned] storage, can output a command signal to a driving means, can move a jaw, i.e., the lower limit section of moving teeth, so that the variation may become abbreviation 0, and it can adjust an addendum real clearance to a request value. Thereby, since it is automatically adjusted to the set point while a setup of a radial clearance is appropriately attained according to the class and application of debris-ed, it can obtain the product of always good quality easily, and its working efficiency improves.
[0020] The 8th invention is equipped with the radial-clearance display which displays the addendum real clearance value and the set-up target radial-clearance value which said control unit computed based on the configuration of the 7th invention.
[0021] According to the 8th invention, since an addendum real clearance value and a target radial-clearance value are displayed with a radial-clearance display, it becomes easy [an operator] to check and tuning becomes easy.
[0022] The 9th invention has a moving limit detection means to detect that the supporting point of operation arrived at the critical range of operation beforehand set to the radial-clearance

open side based on the configuration of the 1st invention. A control unit When the location of the supporting point of operation which inputted the detecting signal from a location detection means and a moving limit detection means, and was detected with the location detection means during crushing crosses the tolerance of the gap defined beforehand, Or when it is judged that said supporting point of operation arrived at the critical range of operation based on the detecting signal of a moving limit detection means, it is considering as the configuration which outputs the command signal which suspends actuation of the jaw crasher by the eccentric shaft, and actuation of the feeder which supplies debris-ed to a jaw crasher.

[0023] According to the 9th invention, a control unit judges whether the location of the supporting point of operation crossed the tolerance of the gap set up beforehand. Or it judges whether the location of the supporting point of operation arrived at the critical range of operation set up beforehand. And when the supporting point of operation crosses the tolerance of a gap, or when a critical range of operation is arrived at, actuation of a jaw crasher and a feeder is suspended. Therefore, before an operator knows, while a defect product can prevent being produced so much, breakage of equipment can be prevented beforehand.

[0024] The 10th invention is taken as the configuration which outputs the command signal which suspends actuation of the jaw crasher by the eccentric shaft, and/or actuation of a feeder, when it enters in the migration keepout area by which the supporting point of operation after addendum clearance adjustment set up the control unit beforehand based on the configuration of the 1st invention near the criteria location at the time of contact to an anchor tooth and moving teeth on the occasion of addendum clearance adjustment.

[0025] According to the 10th invention, a control unit can suspend actuation of a jaw crasher and/or a feeder, when the supporting point of operation enters in a migration keepout area with a possibility that an anchor tooth and moving teeth may approach and interfere. Therefore, interference with an anchor tooth and moving teeth is prevented, and damage on equipment can be prevented beforehand.

[0026] As for the 11th invention, two or more shredding equipment is arranged by the serial based on the configuration of the 9th or 10th invention. When suspending the jaw crasher of the shredding equipment of the downstream which crushes in response to supply of debris from the debris transport device of the shredding equipment of the upstream, and/or said actuation of a feeder It is considering as the configuration which has an output means to output the command signal which makes coincidence suspend actuation of a feeder at least among the jaw crasher of the shredding equipment of the upstream, a feeder, and a debris transport device, in the shredding equipment of the downstream.

[0027] According to the 11th invention, when suspending the jaw crasher of the shredding equipment of the downstream, and/or actuation of a feeder, it has an output means to output to coincidence the command signal of the shredding equipment of the upstream which stops actuation of a feeder at least, in the shredding equipment of the downstream. Even when the shredding equipment of the downstream carries out a crushing halt, while excessive debris-ed is not supplied to the jaw crasher of the downstream, the activity of human power removing excessive debris-ed at the time of a reboot becomes unnecessary and an operator's load is mitigated by this, crushing can be performed efficiently. Therefore, since it becomes applicable at serial arrangement of two or more shredding equipment and the debris of various grain size according to the class of debris-ed, the application of debris, etc. can be manufactured, the versatility of shredding equipment becomes large.

[0028]

[Embodiment of the Invention] Below, the operation gestalt of the addendum clearance adjustment equipment of the shredding equipment concerning this invention and its adjustment approach is explained in full detail with reference to a drawing.

[0029] Drawing 1 is the transverse-plane sectional view of the shredding equipment 1 of the 1st operation gestalt, and drawing 2 is the A-A view Fig. of drawing 1 . In drawing 1 , the jaw crasher 2 has a frame 3, an anchor tooth 4, moving teeth 5, and an eccentric shaft 7. In a frame 3, the anchor tooth 4 set up in the abbreviation vertical direction is faced, and moving teeth 5 are formed rockable and form the crushing room 6 of a cross-section V typeface with an anchor

tooth 4 and moving teeth 5. The upper limit section of the jaw 16 in which moving teeth 5 were attached is supported to revolve possible [eccentric movement] with an eccentric shaft 7, and the lower limit section is restrained by radii movement of the toggle plate 10 almost free [rocking of the vertical direction]. The feeder 9 which throws debris-ed into the crushing room 6 is arranged above a jaw crasher 2, and shredding equipment 1 is constituted with the jaw crasher 2. Moreover, the front end section 11 of the toggle plate 10 is in contact with the tooth-back side of the lower limit section of moving teeth 5 free [rotation], and the back end section is in contact with the point of the toggle block 13 free [rotation]. The back end section of the toggle plate 10 is the radix point of said radii movement of the toggle plate 10, and serves as the supporting point 12 of lower limit section 5a of moving teeth 5 of operation. As the toggle block 13 is laid possible [sliding] towards moving teeth 5 on the lower frame 8 fixed to the frame 3 and is shown in drawing 1 and drawing 2 , the back end section is connected with the lower frame 8 through one pair of oil hydraulic cylinders 21 and 21. Furthermore, as shown in drawing 2 , one pair of tension rods 14 and 14 for pinching the toggle plate 10 between moving teeth 5 and the toggle block 13 are formed in the right-and-left both sides of one pair of oil hydraulic cylinders 21 and 21. One pair of tension rods 14 and 14 are energized in the direction which compresses the toggle plate 10 between moving teeth 5 and the toggle block 13 with springs 15 and 15. In drawing 1 and drawing 2 , moving teeth 5 rock an eccentric shaft 7 as a core, and lower limit section 5a of moving teeth 5 moves them almost horizontally by expanding and contracting oil hydraulic cylinders 21 and 21. Thereby, the radial clearance W formed between lower limit section 4a of an anchor tooth 4 and lower limit section 5a of moving teeth 5 changes. That is, the particle size (grain size) of debris can be changed.

[0030] A location detection means 22 to detect the flexible location of an oil hydraulic cylinder 21 is formed in the oil hydraulic cylinder 21. The location detection means 22 is a potentiometer and can detect telescopic motion of an oil hydraulic cylinder 21, i.e., the location of the supporting point 12 of operation. In addition, although the supporting point 12 of operation shown in drawing 1 is the mechanical supporting point of operation, the supporting point of operation used as the criteria for computing the radial clearance W concerning this invention is not limited to the location of this supporting point 12 of operation, and the position from which the movement magnitude of an oil hydraulic cylinder 21 and relation with a radial clearance W are obtained is said.

[0031] Drawing 3 is the oil pressure circuit diagram of the driving means 20 which drives the oil hydraulic cylinder 21 to which lower limit section 5a of moving teeth 5 is moved almost horizontally. In this drawing, a hydraulic pump 24 and one pair of oil hydraulic cylinders 21 and 21 are connected through a solenoid operated directional control valve 25. A solenoid operated directional control valve 25 is 3 location change-over valve, C location is equivalent to a contraction location, and B location is equivalent to a center valve position for the A location in the elongation location of an oil hydraulic cylinder 21. Moreover, the actuation solenoid section of a solenoid operated directional control valve 25 has connected with a control unit 30, and a solenoid operated directional control valve 25 switches with the command signal from a control unit 30. The one-way valve 27 is formed on the bottom circuit 26 which connects the output port of a solenoid operated directional control valve 25, and the bottom room of an oil hydraulic cylinder 21, and even if the external force by the side of contraction joins an oil hydraulic cylinder 21, the bottom circuit 26 is closed by the one-way valve 27, and reduces an oil hydraulic cylinder 21 by it. The contact detection means 28 was formed in the upstream of the one-way valve 27 of the bottom circuit 26, and the contact detecting signal by the contact detection means 28 is connected to a control unit 30. The contact detection means 28 is constituted by the pressure switch etc., and if the oil pressure of the bottom circuit 26 rises to a predetermined pressure and a pressure switch is turned on, it will output a contact detecting signal to a control unit 30. Moreover, the detecting signal of the location detection means 22 attached in the oil hydraulic cylinder 21 is inputted into the control unit 30.

[0032] If a solenoid operated directional control valve 25 is switched to A location with the command signal from a control unit 30, an oil hydraulic cylinder 21 will be elongated, if it is made C location, an oil hydraulic cylinder 21 will be reduced, and if it is made B location, an oil

hydraulic cylinder 21 will suspend migration. If an oil hydraulic cylinder 21 is elongated, a radial clearance W will become small gradually, and if lower limit section 4a of an anchor tooth 4 and lower limit section 5a of moving teeth 5 contact, the oil pressure of the bottom room of an oil hydraulic cylinder 21 will rise. The contact detection means 28 detects contact to an anchor tooth 4 and moving teeth 5 by this oil pressure rise. In addition, while a strain gage may be used or moving teeth 5 are moved in the direction of an anchor tooth 4, you may make it the contact detection means 28 judge the case where the detection value of the location detection means 22 will not change to be contact.

[0033] Next, the calculation approach of a radial clearance W is explained. Lower limit section 4a of an anchor tooth 4 and lower limit section 5a of moving teeth 5 contacted, namely, a radial clearance W is computed and adjusted on the basis of the location of the supporting point 12 of operation at the time of a radial clearance W serving as zero. Here, the location of addendum 5a of moving teeth 5 is geometrically computable with reference to angle of rotation of an eccentric shaft 7, the distance of the axial center of an eccentric shaft 7, and the front end section 11 of the toggle plate 10, the die length of the toggle plate 10, etc. based on the location of the supporting point 12 of operation.

[0034] Drawing 4 is the explanatory view of a radial-clearance property showing the detection value of the location detection means 22, i.e., the location of the supporting point 12 of operation and relation with a radial clearance W. The axis of abscissa of this drawing is the detection value of the location detection means 22, and an axis of ordinate is a radial clearance W. This radial-clearance property is searched for according to physical relationship geometric as mentioned above, and is memorized in the memory of a control unit 30 corresponding to the location detection value for every predetermined distance. In this drawing, the point Ao on an axis of abscissa is the detection value of the location detection means 22 when each of lower limit sections 4a and 5a contact, when an anchor tooth 4 and moving teeth 5 are new articles, and it computes a radial clearance W based on the radial-clearance property fo in this case. An is the detection value of the location detection means 22 at the time of contact to the anchor tooth 4 after Addenda 4a and 5a carry out specified quantity wear (that is, after predetermined time operation), and moving teeth 5, and computes a radial clearance W based on the radial-clearance property fn which updated the radial-clearance property from fo to fn, and updated it in this case. Az is a detection value at the time of the wear limitation of an anchor tooth 4 and moving teeth 5, and the radial-clearance property at this time is fz. The point Ak on an axis of abscissa is a mechanical movement marginal location here. In addition, although the curve shown in the continuous line of this graph is calculated geometrically as mentioned above and asked, the curve for which it asked by this operation as a thin dashed line showed may be transposed to an approximation straight line. Moreover, the predetermined function based on the geometric relation which made the location detection value the variable may express the radial-clearance property fn, and you may ask for a radial clearance W by calculating this function value according to a location detection value at the time of real actuation.

[0035] Renewal of a radial-clearance property is performed according to the example of a flow chart shown in drawing 5 . In this flow chart, a control unit 30 inputs the detecting signal from the contact detection means 28 at step 41, and it judges whether an anchor tooth 4 and moving teeth 5 contacted. When it contacts, it progresses to step 42, the location detecting signal An from the location detection means 22 is inputted, the new radial-clearance property fn is calculated based on this location detecting signal An, and it updates in this property, and after this, based on the new radial-clearance property fn, a radial clearance W is computed until an anchor tooth 4 and moving teeth 5 next contact. When not in contact at step 41, it progresses to step 43, and a radial clearance W is computed based on radial-clearance property fn-1 then memorized.

[0036] Next, the radial-clearance control approach is explained. Drawing 6 is the control configuration block Fig. of the shredding equipment of the 1st operation gestalt. A driving means 20 is a driving means of the oil hydraulic cylinder 21 as shown in above-mentioned drawing 3 . The radial-clearance display 32 has digital-readout machines, such as for example, an LED drop and a graphical display machine, and displays said calculated radial-clearance value on this drop.

Wear information equipment 33 reports this to an operator etc., when the abrasion loss of an anchor tooth 4 and/or moving teeth 5 reaches the wear limitation beyond a predetermined value, and it is constituted by voice generating means, such as display means, such as a graphical display machine, a character indicator, and an alarm lamp, and a buzzer, or such combination. And it connects with the moving-teeth keying-signal input means 31 which consists of an addendum adjustment manual initiation switch, a moving-teeth open command switch, a moving-teeth close command switch, etc., the contact detection means 28, and the location detection means 22, and a control device 30 inputs the command signal and detecting signal from these means. Moreover, a control unit 30 performs predetermined data processing based on these input signals, outputs a predetermined drive command to the solenoid operated directional control valve 25 of a driving means 20 based on the result of an operation, and outputs a display command to the radial-clearance display 32, and he is trying to output the information command at the time of a wear limitation to wear information equipment 33 further.

[0037] In adjusting a radial clearance, an operator inputs an addendum adjustment actuation initiation command into a control unit 30 manually first with said addendum adjustment manual initiation switch of the moving-teeth keying-signal input means 31. Then, this elongates an oil hydraulic cylinder 21, turn moving teeth 5 to an anchor tooth 4, and it is made to output the command which closes moving teeth 5 automatically to a driving means 20, and to move, and a control unit 30 will suspend migration of moving teeth 5, if the contact detection means 28 detects contact to an anchor tooth 4 and moving teeth 5. And the location detecting signal An of the location detection means 22 at this time is inputted, the new radial-clearance property fn is calculated based on this location detecting signal An, and radial-clearance property fn-1 (an initial property is fo) of until is updated in the new radial-clearance property fn. The radial-clearance value which computed and computed the radial clearance W based on the radial-clearance property fn according to the magnitude of the location detection value of the location detection means 22 is displayed on the radial-clearance display 32 after this. In addition, a control unit 30 performs automatically operation of the radial-clearance property fn, and processing of updating from the above-mentioned moving-teeth close initiation.

[0038] Next, an operator inputs a moving-teeth opening signal or a moving-teeth close signal into a control unit 30 manually with said moving-teeth open command switch of the moving-teeth keying-signal input means 31, or a moving-teeth close command switch, drives an oil hydraulic cylinder 21 through a driving means 20, looking at the current radial-clearance value displayed on the radial-clearance display 32, and moves moving teeth 5 in the open direction or the closed direction. At this time, it is made to move with crawling by inching actuation of the moving-teeth keying-signal input means 31, and it can be accurate and can position. If it becomes a desired radial clearance, an operator will turn off actuation of the moving-teeth keying-signal input means 31, and will stop migration. By the above actuation, an operator is accurate for the desired radial clearance W, and can adjust easily.

[0039] Next, the addendum wear information approach is explained. Only predetermined marginal abrasion loss sets up the big wear threshold value Az beforehand, and the operator makes the predetermined memory in a control unit 30 memorize it rather than this detection value Ao on the basis of the detection value Ao of the location detection means 22 at the time of the contact detection means 28 detecting both contact, when an anchor tooth 4 and moving teeth 5 are new articles. Then, a control unit 30 will report having arrived at the wear limitation to an operator by outputting an alarm command to wear information equipment 33, if the detection value of the location detection means 22 at the time of contact reaches said set-up wear threshold value Az whenever it contacts an anchor tooth 4 and moving teeth 5. Moreover, the control unit 30 memorizes said detection value Ao, and computes, the difference value "Am-Ao" of wear, i.e., amount, of this detection value Ao and the detection value Am at the time of contact at each time, and when this amount of wear "Am-Ao" becomes larger than the amount of marginal wear "Az-Ao" set up beforehand, it outputs an alarm command to wear information equipment 33, and you may make it report it. An operator can stop the drive of shredding equipment 1 in response to this information, and can perform predetermined treatment, such as carrying out vertical reversal of whether an anchor tooth 4 and/or moving teeth 5 are exchanged

for a new article.
[0040] Next, the 2nd operation gestalt is explained based on drawing 7 . Drawing 7 is the control configuration block Fig. of the shredding equipment of this operation gestalt. The radial-clearance setting means 36 is for carrying out the numerical input of the radial-clearance data, for example, numerical input switches, such as a ten key and a digital switch, a write-in switch, etc. can constitute it. Or you may make it input setting data and a setting command by communication link. Moreover, the addendum clearance adjustment initiation means 37 is a means to make it start to regulate [of a radial clearance] automatically, for example, may be constituted from an adjustment initiation switch, and you may make it input an adjustment initiation command by communication link. A control unit 30 inputs numeric data, a command signal, a detecting signal, etc. from the radial-clearance setting means 36, the addendum clearance adjustment initiation means 37, the contact detection means 28, and the location detection means 22, and performs predetermined processing based on these data and signals. And according to this processing result, a predetermined command signal is outputted to a driving means 20 and the radial-clearance display 32, respectively.
[0041] When adjusting a radial clearance, an operator inputs desired radial-clearance data into a control unit 30 with the radial-clearance setting means 36 first, and makes it memorize. Next, an operator inputs the adjustment start signal of a radial clearance into a control unit 30 with the addendum clearance adjustment initiation means 37. The control unit 30 which inputted the adjustment start signal performs the following actuation automatically. First, a command signal is outputted to a driving means 20, and an oil hydraulic cylinder 21 is elongated, and moving teeth 5 are turned to an anchor tooth 4, and it is made to move. If the contact detection means 28 detects contact to an anchor tooth 4 and moving teeth 5, elongation of an oil hydraulic cylinder 21 will be suspended and a radial-clearance property will be updated to coincidence on the basis of the detection value of the location detection means 22 at that time. Next, a target position of the supporting point 12 of operation where an actual radial clearance becomes equal to said inputted desired radial-clearance data is computed based on said updated radial-clearance property, a contraction command signal is outputted to an oil hydraulic cylinder 21 so that the actual supporting point 12 of operation may become this target position, and if the detection value of the location detection means 22 becomes equal to this target position, actuation of an oil hydraulic cylinder will be suspended. Since it is automatically adjusted to the set-up radial clearance by the above actuation, tuning becomes very easy. Moreover, since it can be set as the radial clearance according to the class and application of a crushed object of a work site, this shredding equipment can be used general-purpose.
[0042] Next, the 3rd operation gestalt is explained. Drawing 8 is the transverse-plane sectional view of the shredding equipment of this operation gestalt. In this drawing, the same sign is given to the same component as drawing 1 , and explanation here is omitted. The problem that an overload joins a jaw crasher 2 during crushing, a radial clearance W becomes large when it shifts across the tolerance range of a gap where the supporting point 12 of operation was defined beforehand, and product quality deteriorates (that is, grain size becomes large) occurs. Moreover, shredding equipment may be damaged, if a gap of the supporting point 12 of operation arrives at a mechanical movement marginal location and still more excessive external force is added. Furthermore, when a radial clearance W becomes [too little] too much, an anchor tooth 4 and moving teeth 5 may interfere at the time of rocking of moving teeth 5, and it may become the cause of equipment breakage. In order to prevent these, the shredding equipment of this invention has the overload protecting function and the interference prevention function.
[0043] If an oil hydraulic cylinder 21 is reduced, the toggle block 13 has structure which contacts the lower frame 8 in a predetermined location. A moving limit detection means 23 to detect that this contact location arrived at the predetermined location where it is the mechanical movement marginal location of the toggle block 13, and the toggle block 13 separated only predetermined distance from this mechanical movement marginal location is established between the lower frame 8 and the toggle block 13. The moving limit detection means 23 consists of position transducers, such as a limit switch and a proximity switch. In addition, you may serve as the moving limit detection means 23 with the location detection means 22.

[0044] Drawing 9 is the control configuration block Fig. of the shredding equipment of this operation gestalt. It connects with the contact detection means 28, the location detection means 22, and the moving limit detection means 23, and a control unit 30 inputs each detecting signal. Moreover, a control unit 30 performs predetermined data processing based on these detecting signals, and outputs each drive command signal to the feeder driving means 35, such as a hydraulic motor which drives the eccentric shaft driving means 34, such as a hydraulic motor which carries out the rotation drive of the eccentric shaft 7 of a jaw crasher 2 based on this result of an operation, and a feeder 9.
[0045] Next, actuation by the above-mentioned configuration is explained. An operator sets up the migration keepout area of the moving teeth 5 for preventing beforehand interference with the moving limit location detected with Tolerance L and the moving limit detection means 23 of a supporting-point gap of operation for QA and an anchor tooth 4, and moving teeth 5, and makes the control unit 30 memorize. Drawing 10 is the explanatory view of each of these setting locations, and the axis of abscissa of this drawing expresses the detection location of the location detection means 22. The criteria location Bo is a detection location of the supporting point 12 of operation when an anchor tooth 4 and moving teeth 5 touch at the time of a certain clearance adjustment, and a location Bn is a detection location of the supporting point 12 of operation when adjusting to the desired radial clearance W. The tolerance location Bs of a required gap is set as the location of the predetermined distance L (L is the tolerance value of a gap) on QA from a location Bn. A location Ak is a mechanical movement marginal location, and sets up the moving limit location Am where only the predetermined distance M is detected by the moving limit detection means 23 from a location Ak in a front location. The location Bp which only the predetermined distance N separated from the criteria location Bo to the open side of moving teeth 5 is set up, and between the criteria location Bo and locations Bp is made into the migration keepout area with fear of interference of the solid gear tooth 4 and moving teeth 5. In addition, a location Az is a location it is considered that is a wear limitation, when the supporting point 12 of operation when contacting an anchor tooth 4 and moving teeth 5 comes to this location Az.
[0046] Last time, a control unit 30 moves the supporting point 12 of moving teeth 5 of operation, performs addendum clearance adjustment, and memorizes the detection location Bn of the location detection means 22 when deciding the location of the supporting point 12 of operation. Then, when the distance between both locations, i.e., the absolute value of "Bn-B", is calculated based on said detection location Bn and the detection location B of the location detection means 22 under crushing and the distance between both locations becomes beyond the tolerance value L of a gap, a control unit 30 outputs an actuation stop signal to the eccentric shaft driving means 34 and the feeder driving means 35, stops actuation, and prevents generating of a defective. Moreover, when the distance between both the above-mentioned locations is smaller than the tolerance value L of a gap and the moving limit detection means 23 detects when the detection location B under crushing approached the mechanical movement marginal location Ak across the moving limit location Am namely, a control unit 30 stops actuation of the eccentric shaft driving means 34 and the feeder driving means 35, and, thereby, prevents damage on a machine. Furthermore, a control unit 30 memorizes the detection location of the location detection means 22 when an anchor tooth 4 and moving teeth 5 contact on the occasion of the last clearance adjustment as a criteria location Bo, and calculates the distance of the detection location B of the location detection means 22, and said criteria location Bo, i.e., the absolute value of "Bo-B", during crushing after addendum clearance adjustment. And when the distance between both locations turns into below the predetermined distance N, it judges that the detection location B reached the about four anchor tooth migration keepout area, and actuation of the eccentric shaft driving means 34 and the feeder driving means 35 is suspended, interference with an anchor tooth 4 and moving teeth 5 is prevented, and, thereby, breakage of shredding equipment can be prevented beforehand.
[0047] In the case of the so-called self-propelled crusher carried on the car which can move the shredding equipment of the above configurations freely, the activity which arranges two or more sets of self-propelled crushers in a serial, and crushes debris finely one by one may be done.

Drawing 11 shows the example of application which arranged two sets of the self-propelled crushers 50a and 50b in the serial. The shredding equipment 1a and 1b which consists of jaw-crasher 2a, 2b, and feeders 9a and 9b, respectively is carried in each base carriers 51a and 51b of two sets of the self-propelled crushers 50a and 50b. Under each jaw-crasher 2a and the 2b, the debris transport devices 52a and 52b which take out debris outside are formed, respectively. Self-propelled crusher 50b of the downstream receives supply of debris in feeder 9b from debris transport-device 52of self-propelled crusher 50a of the upstream a, and crushes still more finely with jaw-crasher 2b (secondary crushing). It is continued by supplying debris debris transport-device 52of self-propelled crusher 50a of the upstream a, even if a problem which was mentioned above in the shredding equipment of the downstream occurs in such serial application and it suspends actuation of feeder 9b and jaw-crasher 2b to it. Therefore, debris is filled with feeder 9b and jaw-crasher 2b of self-propelled crusher 50b of the downstream, when rebooting, they must remove choked debris by human power, and they need a great effort and time amount.

[0048] In order to solve the above-mentioned problem, the control device of the addendum clearance adjustment equipment of the shredding equipment concerning this invention has the interlock function of self-propelled shredding equipment 50a of the upstream to stop actuation of feeder 9a at least at the same time it carries out an actuation halt of feeder 9b and/or jaw-crasher 2b of self-propelled crusher 50b of the downstream. Drawing 12 is the configuration block Fig. of the interlock function between an upstream crusher and a downstream crusher. Control unit 30of self-propelled crusher 50b of the downstream b has the 1st external output section 53 which consists of a wireless transmitter, and control unit 30of self-propelled crusher 50a of the upstream a has the radio set 55. In stopping feeder 9b and/or jaw-crasher 2b of self-propelled crusher 50b of the downstream, a halt command signal is outputted to self-propelled crusher 50a of the upstream by wireless from the 1st external output section 53, and the radio set 55 of the upstream receives this, and inputs it into control unit 30a, and he is trying for control unit 30a to stop actuation of feeder 9a at least. With this interlock signal, also in a halt, a lot of debris is not supplied to self-propelled crusher 50b, therefore an operator does not need to remove excessive debris at the time of a reboot, and self-propelled crusher 50b of the downstream can reboot easily. In addition, since it is the interlock by wireless, migration of both the self-propelled mode crusher, arrangement, etc. can be performed free [without being influenced]. Moreover, control unit 30of self-propelled crusher 50b of the downstream b may have the 2nd external output section 54. The 2nd external output section 54 consists of output circuits by a relay or the electronic circuitry (circuits, such as a transistor and a logic IC), and is connected to control unit 30of self-propelled crusher 50a of the upstream a with the cable. Although the operation in this case and effectiveness are almost the same as that of the interlock by the above-mentioned wireless, they can be manufactured [rather than] at cheap cost using a walkie-talkie.

[0049] According to this invention, the following effectiveness is acquired as explained above.

(1) Since it is asking for the radial clearance on the basis of the location where an anchor tooth and moving teeth contacted, the operation based on the distance from a machine home position becomes unnecessary, and can compute the exact radial clearance of a jaw crasher by the easy operation. Therefore, since the operation load of processing units, such as CPU of a control unit, is mitigable, cost reduction and a lightweight miniaturization can be performed.

(2) Since the operation based on the distance from a machine home position became unnecessary, it becomes unnecessary moreover, to set up a machine home position correctly at the time of repair or maintenance check. Thereby, easily, a co-ordinate-basic-origin setting activity can also be done in a short time, and can mitigate an operator's effort sharply.

(3) Further, since a radial-clearance setup according to the class and application of debris-ed can be performed easily, the product of high quality, i.e., the debris of a desired grain size, can be obtained without variation. Thereby, applicability is wide and the high shredding equipment of versatility is obtained.

(4) Moreover, since a radial clearance can be measured with a sufficient precision, also whenever [wear / of an anchor tooth and moving teeth] can be measured correctly, and, therefore,

addendum exchange at the time of wear can be performed effective in a suitable stage. Therefore, while there is no futility about the substitute part of an addendum and being able to use it, without moreover degrading the precision of a product, the count of a maintenance service can be reduced.
(5) Since it was made stop actuation and the feeder of moving teeth when the location of the supporting point of moving teeth of operation is continuously monitored after addendum clearance adjustment, an overload was added during crushing, moving teeth crossed the tolerance range of a gap and the moving limit location near the co-ordinate basic origin was crossed, or when it entered in the migration keepout area near the anchor tooth, breakage of the shredding equipment which is easy to generate by the mistake of human decision can be prevented beforehand certainly.
(6) When using it according to the class of debris-ed, or the application of debris, arranging two or more shredding equipment in a serial, since a feeder is stopped at least or it was made to suspend a jaw crasher in addition to this, the thing of the shredding equipment of the upstream for which the shredding equipment of the downstream is covered with debris so much is lost at the time of a crushing halt of the shredding equipment of the downstream, and re-initiation of an activity can be performed easily at it. Furthermore, since a feeder is stopped at least, generating of failure of the shredding equipment of the upstream by the thing of the shredding equipment of the upstream which debris-ed accumulates in the jaw crasher of the shredding equipment of the upstream so much with a halt of the shredding equipment of the downstream can be prevented beforehand.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the transverse-plane sectional view of the shredding equipment of the 1st operation gestalt of this invention.
[Drawing 2] It is the A-A view Fig. of drawing 1 .
[Drawing 3] It is the oil pressure circuit diagram of the driving means of this invention.
[Drawing 4] It is the explanatory view showing the relation between the detection value of a location detection means, and a radial clearance of a radial-clearance property.
[Drawing 5] It is the example of a flow chart of renewal of a radial-clearance property.
[Drawing 6] It is the control configuration block Fig. of the 1st operation gestalt.
[Drawing 7] It is the control configuration block Fig. of the 2nd operation gestalt.
[Drawing 8] It is the transverse-plane sectional view of the shredding equipment of the 3rd operation gestalt.
[Drawing 9] It is the control configuration block Fig. of the 3rd operation gestalt.
[Drawing 10] It is the explanatory view of each setting location concerning an overload protecting function.
[Drawing 11] It is the explanatory view of the example of application to the activity by serial arrangement of a self-propelled crusher.
[Drawing 12] It is the configuration block Fig. of the interlock function between an upstream crusher and a downstream crusher.
[Description of Notations]
Shredding equipment, 2:jaw crasher, 3:frame, 4 : 1: An anchor tooth, 4a, a 5a:addendum, 5:moving teeth, a 8:lower frame, 9:feeder, 10 : A toggle plate, 12: The supporting point of operation, 13:toggle block, 20:driving means, 21 : An oil hydraulic cylinder, 22: A location detection means, 23:moving limit detection means, 28 : A contact detection means, 30 : A control unit, 31:moving-teeth keying-signal input means, 32:radial-clearance display, 33: A wear alarm, 34:eccentric-shaft driving means, 35:feeder driving means, 36:radial-clearance setting means, 37:addendum clearance-adjustment initiation means, 50 and 50a, a 50b:self-propelled-mode crusher, 52a, a 52b:debris transport device, the 53:external [1st] output section, 54: The 2nd external output section.

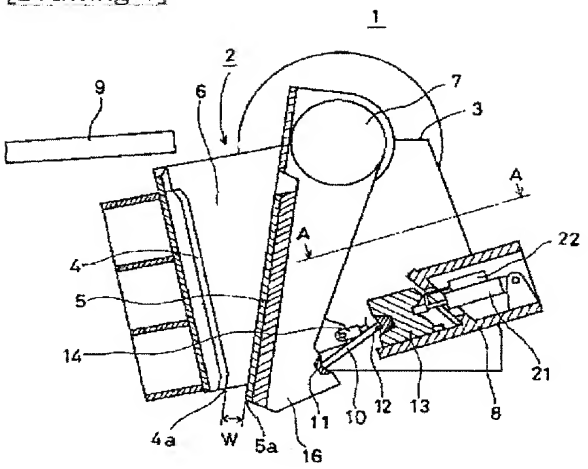
[Translation done.]

* NOTICES *

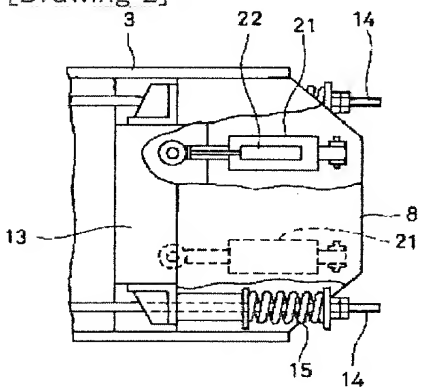
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

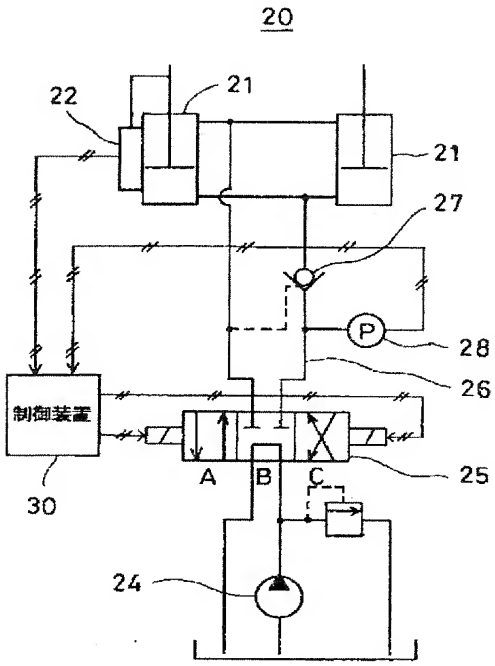
[Drawing 1]



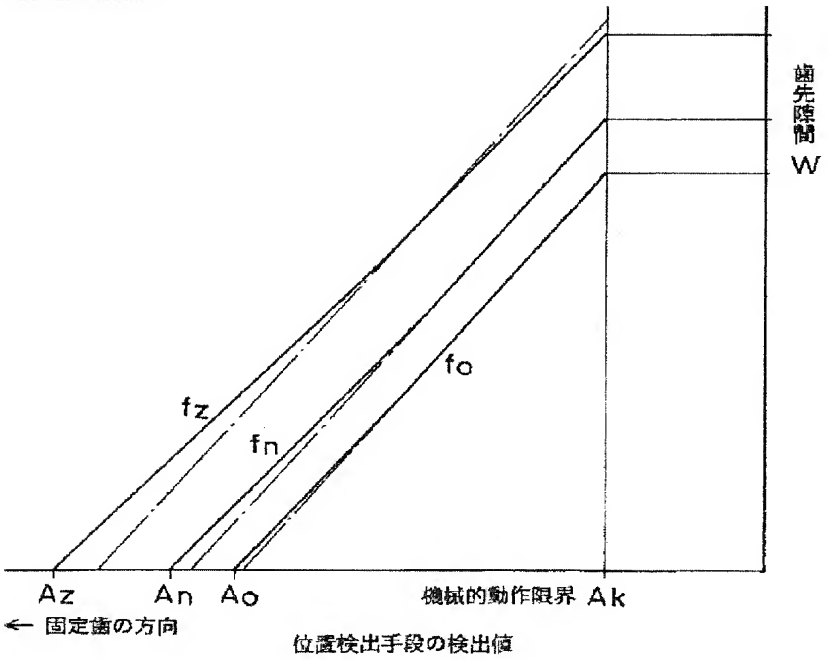
[Drawing 2]



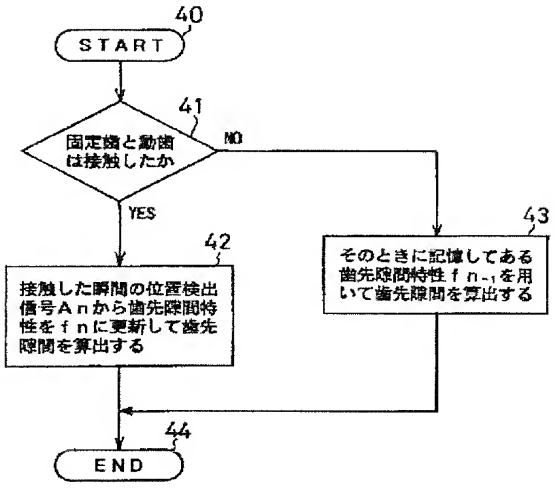
[Drawing 3]



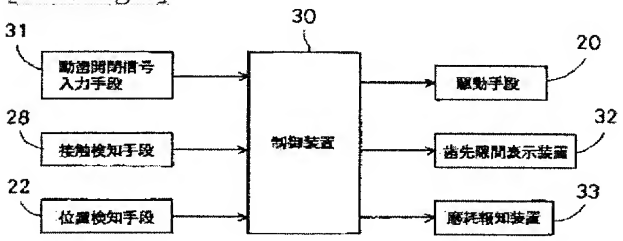
[Drawing 4]



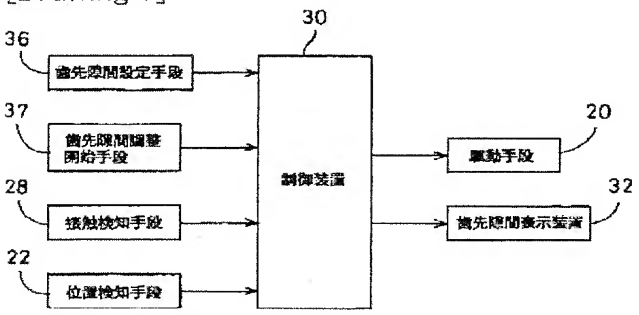
[Drawing 5]



[Drawing 6]



[Drawing 7]



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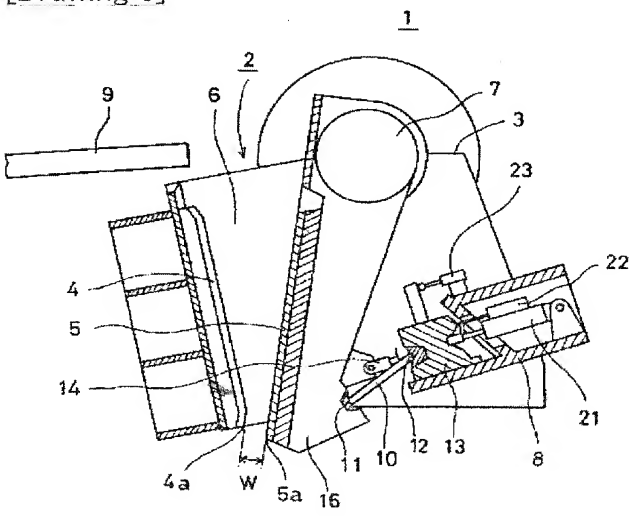

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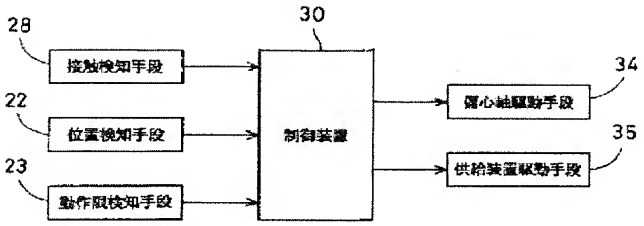

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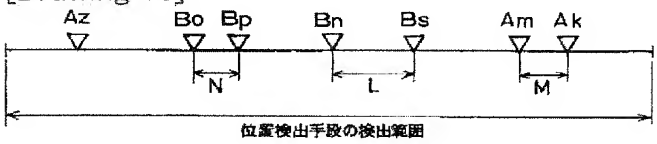

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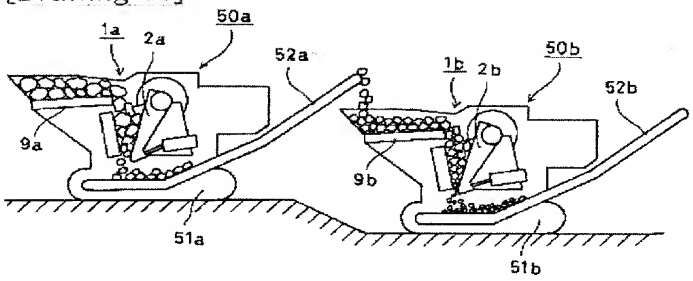

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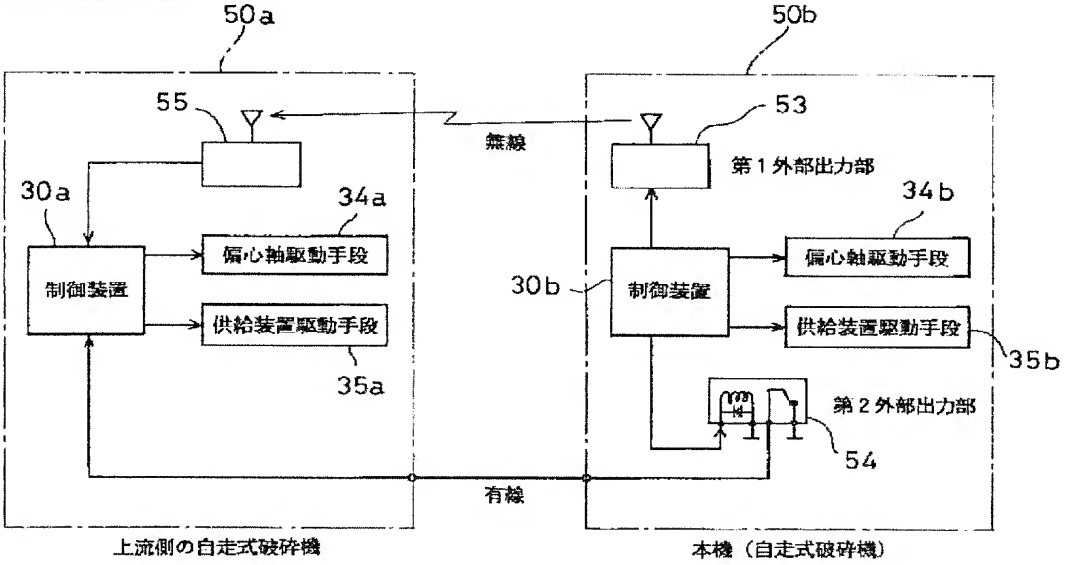

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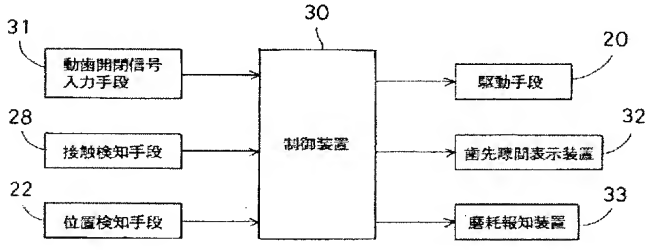
最終頁に続く

(54)【発明の名称】破砕装置の歯先隙間調整装置及びその調整方法

(57)【要約】
【課題】　ジョークラッシャーを有する破砕装置の歯先隙間調整において、演算簡単化、調整容易化、高精度化を図る。また、歯先隙間の設定変更を容易化する。さらに、過負荷による装置破損を未然に防止する。
【解決手段】　固定歯(4)と揺動自在とされた動歯(5)とにより断面Ｖ字形の破砕室(6)を形成し、かつ動歯(5)を取着したジョー(16)の上端部を偏心運動可能に軸支し、下部を、移動自在とされたトグルプレート(10)の一端を基点とした他端の円弧運動により運動自在に拘束してなるジョークラッシャー(2)を有し、トグルプレート(10)を介してジョー(16)を移動させて、固定歯(4)と動歯(5)間の歯先隙間を調整する破砕装置の歯先隙間調整装置において、固定歯(4)と動歯(5)との接触の検出手段(28)と、トグルプレート(10)の動作支点(12)位置の検出手段(22)と、前記接触時の動作支点(12)位置を基準として歯先隙間値を算出し、歯先隙間調整時に前記算出した歯先隙間値を出力する制御装置(30)とを備える。



1

【特許請求の範囲】

【請求項１】　フレーム(3) に設けた固定歯(4) とこの固定歯(4) に向かい合って揺動自在とされた動歯(5) とにより断面Ｖ字形の破砕室(6)を形成し、かつ動歯(5) を取着したジョー(16)の上端部を偏心軸(7) により偏心運動可能に軸支し、その下部を、駆動手段(20)によって移動自在とされたトグルブロック(13)に一端が取着されたトグルプレート(10)の前記一端を基点とした他端の円弧運動により運動自在に拘束してなるジョークラッシャー(2) を有し、駆動手段(20)によりトグルブロック(13) 及びトグルプレート(10)を介してジョー(16)の下部を移動させて、固定歯(4) の下端部(4a)と動歯(5) の下端部(5a)との間の歯先隙間を調整する破砕装置の歯先隙間調整装置において、固定歯(4) の下端部(4a)と動歯(5) の下端部(5a)との接触を検出する接触検出手段(28)と、トグルプレート(10)の円弧運動の基点をなす一端側の動作支点(12)の位置を検出する位置検出手段(22)と、接触検出手段(28)及び位置検出手段(22)からの検出信号を入力し、前記接触が検出されたときの動作支点(12)の位置を基準として固定歯(4) と動歯(5) とトグルプレート(10)と動作支点(12)の位置との幾何学的な関係に基づいて動作支点(12)の位置に対応する歯先隙間を算出し、歯先隙間調整時に前記算出した歯先隙間値を出力する制御装置(30)とを備えたことを特徴とする破砕装置の歯先隙間調整装置。

【請求項２】　請求項１記載の破砕装置の歯先隙間調整装置において、前記制御装置(30)が算出した歯先隙間値を表示する歯先隙間表示装置(32)を備えたことを特徴とする破砕装置の歯先隙間調整装置。

【請求項３】　フレーム(3) に設けた固定歯(4) とこの固定歯(4) に向かい合って揺動自在とされた動歯(5) とにより断面Ｖ字形の破砕室(6)を形成し、動歯(5) の下端部(5a)を移動させて、固定歯(4) の下端部(4a)と動歯(5) の下端部(5a)との間の歯先隙間を調整する破砕装置の歯先隙間調整方法において、動歯(5) の下端部(5a)を移動させて固定歯(4) の下端部(4a)と動歯(5) の下端部(5a)とを接触させる工程と、接触したときの動歯(5) の下端部(5a)の位置を検出し、この検出位置を基準として固定歯(4) と動歯(5) と動歯(5) の下端部(5a)の位置との幾何学的な関係に基づいて動歯(5) の下端部(5a)の位置に対応する歯先隙間を算出する工程と、算出した歯先隙間値を歯先隙間表示装置(32)に表示する工程と、作業者が，歯先隙間表示装置(32)に表示された歯先隙間値を見ながら動歯(5) の下端部(5a)を移動させ、所望の歯先隙間に達したときに動歯(5) の下端部(5a)の移動を停止させる工程とを有することを特徴とする破砕装置の歯先隙間調整方法。

【請求項４】　請求項１記載の破砕装置の歯先隙間調整装置において、前記制御装置(30)は、固定歯(4) の下端部(4a)と動歯(5) の下端部(5a)とを最初に接触させたときに位置検出手段(22)により検出した動作支点(12)の位置を初期基準位置として記憶し、接触検出手段(28)により接触を検出する毎に位置検出手段(22)により検出した動作支点(12)の位置と前記記憶した初期基準位置との差値を演算して固定歯(4) 及び動歯(5) の磨耗量を求めることを特徴とする破砕装置の歯先隙間調整装置。

2

【請求項５】　請求項４記載の破砕装置の歯先隙間調整装置において、前記制御装置(30)は、前記初期基準位置に基づいて固定歯(4) 及び動歯(5) の磨耗限界に対応する動作支点(12)の位置又は摩耗量限界値を予め設定して記憶しておき、接触検出手段(28)により接触を検出する毎に、位置検出手段(22)により検出した動作支点(12)の位置と前記記憶した磨耗限界に対応する位置とを比較して、又は前記演算した磨耗量と前記記憶した摩耗量限界値とを比較して、磨耗限界に達したか否かを判断することを特徴とする破砕装置の歯先隙間調整装置。

【請求項６】　請求項５記載の破砕装置の歯先隙間調整装置において、警報指令を入力したとき固定歯(4) 及び動歯(5) が磨耗限界に達したことを報知する磨耗報知装置(33)を付設し、前記制御装置(30)は、固定歯(4) 及び動歯(5) が磨耗限界に達したと判断したときに、磨耗報知装置(33)に前記警報指令を出力することを特徴とする破砕装置の歯先隙間調整装置。

【請求項７】　フレーム(3) に設けた固定歯(4) とこの固定歯(4) に向かい合って揺動自在とされた動歯(5) とにより断面Ｖ字形の破砕室(6)を形成し、かつ動歯(5) を取着したジョー(16)の上端部を偏心軸(7) により偏心運動可能に軸支し、その下部を、駆動手段(20)によって移動自在とされたトグルブロック(13)に一端が取着されたトグルプレート(10)の前記一端を基点とした他端の円弧運動により運動自在に拘束してなるジョークラッシャー(2) を有し、駆動手段(20)によりトグルブロック(13) 及びトグルプレート(10)を介してジョー(16)の下部を移動させて、固定歯(4) の下端部(4a)と動歯(5) の下端部(5a)との間の歯先隙間を調整する破砕装置の歯先隙間調整装置において、固定歯(4) の下端部(4a)と動歯(5) の下端部(5a)との接触を検出する接触検出手段(28)と、トグルプレート(10)の円弧運動の基点をなす一端側の動作支点(12)の位置を検出する位置検出手段(22)と、目標歯先隙間値を設定する歯先隙間設定手段(36)と、歯先隙間設定手段(36)により設定された目標歯先隙間値を予め記憶し、歯先隙間調整時に、接触検出手段(28)及び位置検出手段(22)からの検出信号を入力し、前記接触が検出されたときの動作支点(12)の位置を基準として固定歯(4) と動歯(5) とトグルプレート(10)と動作支点(12)の位置との幾何学的な関係に基づいて動作支点(12)の位置に対応する歯先実隙間を算出し、この歯先実隙間値と前記記憶した目標歯先隙間値との偏差値を常時演算し、前記偏差値が略零になるように駆動手段(20)に指令信号を出力して自動的に歯先実隙間を調整する制御装置(30)とを備

えたことを特徴とする破砕装置の歯先隙間調整装置。

【請求項８】　請求項７記載の破砕装置の歯先隙間調整装置において、前記制御装置(30)が算出した歯先実隙間値及び設定された目標歯先隙間値を表示する歯先隙間表示装置(32)を備えたことを特徴とする破砕装置の歯先隙間調整装置。

【請求項９】　請求項１記載の破砕装置の歯先隙間調整装置において、歯先隙間開側に予め定められた動作限界範囲に動作支点(12)が達したことを検出する動作限検出手段(23)を有し、制御装置(30)は、位置検出手段(22)及び動作限検出手段(23)からの検出信号を入力し、破砕作業中に位置検出手段(22)により検出した動作支点(12)の位置が予め定められたずれの許容範囲を越えた場合、又は動作限検出手段(23)の検出信号に基づき前記動作支点(12)が動作限界範囲に達したと判断した場合に、偏心軸(7)によるジョークラッシャー(2)の作動、及びジョークラッシャー(2)に被破砕物を供給する供給装置(9)の作動を停止する指令信号を出力することを特徴とする破砕装置の歯先隙間調整装置。

【請求項１０】　請求項１記載の破砕装置の歯先隙間調整装置において、

制御装置(30)は、歯先隙間調整後の動作支点(12)が、歯先隙間調整の際に固定歯(4)と動歯(5)との接触時の基準位置近傍に予め設定した移動禁止領域内に入った場合に、偏心軸(7)によるジョークラッシャー(2)の作動、及び／又は供給装置(9)の作動を停止する指令信号を出力することを特徴とする破砕装置の歯先隙間調整装置。

【請求項１１】　請求項９又は１０記載の破砕装置の歯先隙間調整装置において、

複数個の破砕装置(1a, 1b…)が直列に配設され、上流側の破砕装置(1a)の破砕物搬送装置(52a)から破砕物の供給を受けて破砕を行う下流側の破砕装置(1b)のジョークラッシャー(2b)及び／又は供給装置(9b)の前記作動を停止するときに、同時に上流側の破砕装置(1a)のジョークラッシャー(2a)、供給装置(9a)及び破砕物搬送装置(52a)の内少なくとも供給装置(9a)の作動を停止させる指令信号を出力する出力手段(53, 54)を下流側の破砕装置(1b)に有することを特徴とする破砕装置の歯先隙間調整装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、岩石や鉱石等を破砕するジョークラッシャーを用いた破砕装置の歯先隙間調整装置及びその調整方法に関する。

【０００２】

【従来の技術】ジョークラッシャーの固定歯と動歯との間の歯先隙間は、破砕された岩石等の粒度、つまり製品品質に大きく影響する。したがって、歯先隙間の管理は非常に重要である。従来、この歯先隙間を制御すると共に、過負荷時に警報を発する装置については、特許登録第２５７００５７号公報に記載されたものがある。

【０００３】

【発明が解決しようとする課題】しかしながら、特許登録第２５７００５７号公報に記載された構成においては、以下のような問題点がある。

１）磨耗による動歯の退入量の算出時に、機械原点を基準として算出しているので、算出方法が複雑で、制御装置の演算処理装置に演算負荷がかかる。また、磨耗した場合に動歯を交換する際に、作業スペースを確保するために動歯の近傍に配置された油圧シリンダ等の部品も取り外すことがあるが、これによって前記基準となる機械原点が変わってしまうことになるので、部品交換後の歯先隙間調整時には機械原点の位置合わせを精度良く行う必要がある。したがって、歯先隙間調整方法が複雑となり、調整作業に時間がかかる。

２）歯先隙間を所定の一定値に維持するために必要な動歯移動量を算出してこの移動量に相当する油圧ポンプ作動量を演算し、この油圧ポンプ作動量により動歯駆動用油圧シリンダを伸長させて動歯を移動させるので、これらの油圧機器の油漏れ、機器毎の性能誤差等の影響による移動誤差が大きく、歯先隙間の調整精度が良くないことがある。

３）歯先隙間は、被破砕物の種類や破砕物の用途により変更する必要がある。特に、移動式クラッシャーのように、被破砕物の種類及び破砕物の用途が作業現場により異なる場合にはその都度歯先隙間を変更する必要があるが、上記従来技術の場合には歯先隙間は常時一定に調整されるようになっており、したがって用途が限られて破砕装置の適用範囲即ち汎用性が小さい。

４）過負荷時に警報を発して作業者に対応させる方法では作業者の適切な処置を期待するだけなので、人間の処置ミスをカバーすることはできず、最悪の場合には装置の破損を招くことがある。

【０００４】本発明は上記の問題点に着目し、ジョークラッシャーを有する破砕装置の歯先隙間調整において、簡単な演算方法で、調整作業を容易にし、しかも正確に歯先隙間を調整できるようにすることを目的としている。また、他の目的は、被破砕物の種類、破砕物の用途等に応じて歯先隙間の設定変更を容易に行えることである。さらに、別の目的は、過負荷による装置破損を未然に防止できることである。

【０００５】

【課題を解決するための手段、作用及び効果】上記の目的を達成するために、本発明においては、以下説明するように、固定歯と、動歯を取着したジョーと、トグルプレートと、動作支点の位置との幾何学的な関係により求まる歯先隙間特性に基づいて、動作支点の位置に応じた歯先隙間を算出するようにしている。これにより、従来のように動作支点のトグルブロックや駆動手段の側に設けた機械原点に対する動歯下端部位置までの距離演算に

より歯先隙間を求める方法に比較して、演算が非常に容易となり、また動歯交換作業後等の歯先調整作業が簡単になり調整時間も短縮される。

【０００６】即ち、本発明に係る第１発明は、フレームに設けた固定歯とこの固定歯に向かい合って揺動自在とされた動歯とにより断面Ｖ字形の破砕室を形成し、かつ動歯を取着したジョーの上端部を偏心軸により偏心運動可能に軸支し、その下部を、駆動手段によって移動自在とされたトグルブロックに一端が取着されたトグルプレートの前記一端を基点とした他端の円弧運動により運動自在に拘束してなるジョークラッシャーを有し、駆動手段によりトグルブロック及びトグルプレートを介してジョーの下部を移動させて、固定歯の下端部と動歯の下端部との間の歯先隙間を調整する破砕装置の歯先隙間調整装置において、固定歯の下端部と動歯の下端部との接触を検出する接触検出手段と、トグルプレートの円弧運動の基点をなす一端側の動作支点の位置を検出する位置検出手段と、接触検出手段及び位置検出手段からの検出信号を入力し、前記接触が検出されたときの動作支点の位置を基準として固定歯と動歯とトグルプレートと動作支点の位置との幾何学的な関係に基づいて動作支点の位置に対応する歯先隙間を算出し、歯先隙間調整時に前記算出した歯先隙間値を出力する制御装置とを備えた構成としている。

【０００７】第１発明によれば、接触検出手段でジョークラッシャーの固定歯の下端部と動歯の下端部とが接触したことを検出し、そのときの動作支点の位置を位置検出手段で検出し、この位置を基準として動作支点の位置に応じた歯先隙間を算出することができる。これにより、機械原点と前記固定歯と動歯の接触位置との間の距離を基準に磨耗を算出すると共に歯先隙間を調整するという従来技術のような複雑な演算が不要となる。したがって、簡単な演算により歯先隙間値を算出でき、これにより所定の歯先隙間となる位置に動歯を移動させることができる。すなわち、基準位置は固定歯と動歯とが接触したときの動歯の動作支点位置だけとなるため、歯先隙間の算出を容易に、正確に行うことができる。したがって、歯先隙間の変更を容易に行うことができる共に、ＣＰＵ等の演算処理装置の演算負荷を軽減してコスト低減及び装置小型化ができる。

【０００８】第２発明は、第１発明の構成に基づき、前記制御装置が算出した歯先隙間値を表示する歯先隙間表示装置を備えた構成としている。

【０００９】第２発明によれば、制御装置が算出した歯先隙間を歯先隙間表示装置により表示するので、作業者は現在の歯先隙間を容易に確認でき、したがって歯先隙間の調整作業が非常に容易となる。

【００１０】第３発明は、フレームに設けた固定歯とこの固定歯に向かい合って揺動自在とされた動歯とにより断面Ｖ字形の破砕室を形成し、動歯の下端部を移動させて、固定歯の下端部と動歯の下端部との間の歯先隙間を調整する破砕装置の歯先隙間調整方法において、動歯の下端部を移動させて固定歯の下端部と動歯の下端部とを接触させる工程と、接触したときの動歯の下端部の位置を検出し、この検出位置を基準として固定歯と動歯と動歯の下端部の位置との幾何学的な関係に基づいて動歯の下端部の位置に対応する歯先隙間を算出する工程と、算出した歯先隙間値を歯先隙間表示装置に表示する工程と、作業者が，歯先隙間表示装置に表示された歯先隙間値を見ながら動歯の下端部を移動させ、所望の歯先隙間に達したときに動歯の下端部の移動を停止させる工程とを有する方法としている。

【００１１】第３発明によれば、動歯の下端部を移動させ、固定歯の下端部と動歯の下端部とが接触した時の動歯の下端部位置を基準として動歯の下端部位置に応じた歯先隙間を算出する。これにより、上記第１発明の作用の説明段落で行ったように、簡単な演算で、正確な歯先隙間を算出できる。また、算出された歯先隙間値を歯先隙間表示装置に表示し、作業者はその表示値を見ながら歯先隙間の調整を行うことができる。そのため、正確な歯先隙間の調整を容易に行うことができる。したがって、品質の良い製品を得ることができる。

【００１２】第４発明は、第１発明の構成に基づき、前記制御装置は、固定歯の下端部と動歯の下端部とを最初に接触させたときに位置検出手段により検出した動作支点の位置を初期基準位置として記憶し、接触検出手段により接触を検出する毎に位置検出手段により検出した動作支点の位置と前記記憶した初期基準位置との差値を演算して固定歯及び動歯の磨耗量を求める構成としている。

【００１３】第４発明によれば、固定歯及び／又は動歯を交換した後に、固定歯の下端部と動歯の下端部とを最初に接触させたときの動作支点の位置を初期基準位置として記憶し、その後接触させる毎にその時の動作支点の位置と前記記憶した初期基準位置との差値を演算して固定歯及び動歯の磨耗量を求めているので、作業者が現物を測定することなく自動的に正確に磨耗量が測定され、よって磨耗量により歯先の寿命を予測可能となる。したがって、固定歯及び動歯の寿命管理を容易に、正確に行えるので、製品品質（つまり粒度）の精度を均一に維持できる。

【００１４】第５発明は、第４発明の構成に基づき、前記制御装置は、前記初期基準位置に基づいて固定歯及び動歯の磨耗限界に対応する動作支点の位置又は摩耗量限界値を予め設定して記憶しておき、接触検出手段により接触を検出する毎に、位置検出手段により検出した動作支点の位置と前記記憶した磨耗限界に対応する位置とを比較して、又は前記演算した磨耗量と前記記憶した摩耗量限界値とを比較して、磨耗限界に達したか否かを判断している。

【００１５】第５発明によれば、固定歯と動歯とが磨耗限界に達したか否かを作業者が判断することなく、自動的に判定する。したがって、固定歯及び動歯の寿命管理を正確に、容易に行え、適切な時期に固定歯又は動歯の交換ができるので、製品精度を向上できる。

【００１６】第６発明は、第５発明の構成に基づき、警報指令を入力したとき固定歯及び動歯が磨耗限界に達したことを報知する磨耗報知装置を付設し、前記制御装置は、固定歯及び動歯が磨耗限界に達したと判断したときに、磨耗報知装置に前記警報指令を出力する構成としている。

【００１７】第６発明によれば、報知装置（ブザーや表示器等）により作業者は固定歯や動歯が磨耗限界に達したか否かが分かり易い。そのため、固定歯や動歯の交換等の処置をすぐに行えるので、良好な品質の製品を得ることができる。

【００１８】第７発明は、フレームに設けた固定歯とこの固定歯に向かい合って揺動自在とされた動歯とにより断面Ｖ字形の破砕室を形成し、かつ動歯を取着したジョーの上端部を偏心軸により偏心運動可能に軸支し、その下部を、駆動手段によって移動自在とされたトグルブロックに一端が取着されたトグルプレートの前記一端を基点とした他端の円弧運動により運動自在に拘束してなるジョークラッシャーを有し、駆動手段によりトグルブロック及びトグルプレートを介してジョーの下部を移動させて、固定歯の下端部と動歯の下端部との間の歯先隙間を調整する破砕装置の歯先隙間調整装置において、固定歯の下端部と動歯の下端部との接触を検出する接触検出手段と、トグルプレートの円弧運動の基点をなす一端側の動作支点の位置を検出する位置検出手段と、目標歯先隙間値を設定する歯先隙間設定手段と、歯先隙間設定手段により設定された目標歯先隙間値を予め記憶し、歯先隙間調整時に、接触検出手段及び位置検出手段からの検出信号を入力し、前記接触が検出されたときの動作支点の位置を基準として固定歯と動歯とトグルプレートと動作支点の位置との幾何学的な関係に基づいて動作支点の位置に対応する歯先実隙間を算出し、この歯先実隙間値と前記記憶した目標歯先隙間値との偏差値を常時演算し、前記偏差値が略零になるように駆動手段に指令信号を出力して自動的に歯先実隙間を調整する制御装置とを備えた構成としている。

【００１９】第７発明によれば、ジョークラッシャーの歯先隙間を予め所望の目標値に設定し、制御装置にこの値を記憶させる。そして制御装置は、接触検出手段と位置検出手段との検出信号に基づいて算出した歯先実隙間と、上記記憶した目標歯先隙間値との偏差値を常時演算し、その偏差値が略零になるように駆動手段に指令信号を出力してジョー即ち動歯の下端部を移動させ、歯先実隙間を所望値に調整することができる。これにより、歯先隙間は被破砕物の種類や用途に応じて適切に設定可能となると共に、自動的に設定値に調整されるので、常に良好な品質の製品を、容易に得ることができ、作業効率が向上する。

【００２０】第８発明は、第７発明の構成に基づき、前記制御装置が算出した歯先実隙間値及び設定された目標歯先隙間値を表示する歯先隙間表示装置を備えている。

【００２１】第８発明によれば、歯先隙間表示装置により歯先実隙間値及び目標歯先隙間値が表示されるので、作業者は確認が容易となり、調整作業が楽になる。

【００２２】第９発明は、第１発明の構成に基づき、歯先隙間開側に予め定められた動作限界範囲に動作支点が達したことを検出する動作限検出手段を有し、制御装置は、位置検出手段及び動作限検出手段からの検出信号を入力し、破砕作業中に位置検出手段により検出した動作支点の位置が予め定められたずれの許容範囲を越えた場合、又は動作限検出手段の検出信号に基づき前記動作支点が動作限界範囲に達したと判断した場合に、偏心軸によるジョークラッシャーの作動、及びジョークラッシャーに被破砕物を供給する供給装置の作動を停止する指令信号を出力する構成としている。

【００２３】第９発明によれば、制御装置は、動作支点の位置が予め設定されたずれの許容範囲を越えたか否かを判断する。あるいは、動作支点の位置が予め設定された動作限界範囲に達したか否かを判断する。そして、動作支点がずれの許容範囲を越えた場合、又は動作限界範囲に達した場合には、ジョークラッシャー及び供給装置の作動を停止する。そのため、作業者の知らないうちに不良製品が多量に生産されることを防止できると共に、装置の破損を未然に防止できる。

【００２４】第１０発明は、第１発明の構成に基づき、制御装置は、歯先隙間調整後の動作支点が、歯先隙間調整の際に固定歯と動歯との接触時の基準位置近傍に予め設定した移動禁止領域内に入った場合に、偏心軸によるジョークラッシャーの作動、及び／又は供給装置の作動を停止する指令信号を出力する構成としている。

【００２５】第１０発明によれば、制御装置は、固定歯と動歯とが接近して干渉する恐れのある移動禁止領域内に動作支点が入った場合にジョークラッシャー及び／又は供給装置の作動を停止することができる。したがって、固定歯と動歯との干渉を防止し、装置の損傷を未然に防止できる。

【００２６】第１１発明は、第９又は第１０発明の構成に基づき、複数個の破砕装置が直列に配設され、上流側の破砕装置の破砕物搬送装置から破砕物の供給を受けて破砕を行う下流側の破砕装置のジョークラッシャー及び／又は供給装置の前記作動を停止するときに、同時に上流側の破砕装置のジョークラッシャー、供給装置及び破砕物搬送装置の内少なくとも供給装置の作動を停止させる指令信号を出力する出力手段を下流側の破砕装置に有する構成としている。

【００２７】第１１発明によれば、下流側の破砕装置のジョークラッシャー及び／又は供給装置の作動を停止する場合、同時に上流側の破砕装置の少なくとも供給装置の作動を停止させる指令信号を出力する出力手段を下流側の破砕装置に有している。これにより、下流側の破砕装置が破砕停止したときでも下流側のジョークラッシャーに余分な被破砕物が供給されることはなく、再起動時に人力により余分な被破砕物を除去するなどの作業が不要となり、作業者の負荷が軽減されると共に、破砕作業が能率的に行える。よって、複数台の破砕装置の直列配置での適用が可能となり、被破砕物の種類及び破砕物の用途等に応じた多様な粒度の破砕物を製作できるので、破砕装置の汎用性が広くなる。

【００２８】

【発明の実施の形態】以下に、本発明に係る破砕装置の歯先隙間調整装置及びその調整方法の実施形態について、図面を参照して詳述する。

【００２９】図１は第１実施形態の破砕装置１の正面断面図であり、図２は図１のＡ－Ａ矢視図である。図１において、ジョークラッシャー２は、フレーム３と固定歯４と動歯５と偏心軸７とを有している。フレーム３内に略上下方向に立設された固定歯４に向かい合って動歯５が揺動可能に設けられ、固定歯４及び動歯５によって断面Ｖ字形の破砕室６を形成している。動歯５が取着されたジョー１６の上端部は偏心軸７により偏心運動可能に軸支され、下端部はトグルプレート１０の円弧運動によりほぼ上下方向の揺動自在に拘束されている。ジョークラッシャー２の上方には被破砕物を破砕室６に投入する供給装置９が配設され、ジョークラッシャー２と共に破砕装置１を構成している。また、トグルプレート１０の前端部１１は動歯５の下端部の背面側に回動自在に当接しており、後端部はトグルブロック１３の先端部に回動自在に当接している。トグルプレート１０の後端部はトグルプレート１０の前記円弧運動の基点であり、動歯５の下端部５ａの動作支点１２となっている。トグルブロック１３は、フレーム３に固設された下部フレーム８上に動歯５に向けて摺動可能に載置されており、図１及び図２に示すように、その後端部は下部フレーム８に１対の油圧シリンダ２１，２１を介して連結されている。さらに、図２に示すように１対の油圧シリンダ２１，２１の左右両側には、トグルプレート１０を動歯５とトグルブロック１３との間に挟持するための１対のテンションロッド１４，１４が設けられている。１対のテンションロッド１４，１４は、バネ１５，１５により動歯５とトグルブロック１３との間にトグルプレート１０を圧縮する方向に付勢している。図１、図２において、油圧シリンダ２１，２１を伸縮することにより動歯５は偏心軸７を中心として揺動し、動歯５の下端部５ａはほぼ水平方向に移動する。これにより、固定歯４の下端部４ａと動歯５の下端部５ａとの間に形成される歯先隙間Ｗは変化する。すなわち、破砕物の粒径（粒度）を変化させることができる。

【００３０】油圧シリンダ２１には油圧シリンダ２１の伸縮位置を検出する位置検出手段２２が設けられている。位置検出手段２２は例えばポテンショメータであり、油圧シリンダ２１の伸縮、すなわち、動作支点１２の位置を検出することができる。尚、図１に示す動作支点１２は機械的な動作支点であるが、本発明に係る歯先隙間Ｗを算出するための基準となる動作支点はこの動作支点１２の位置に限定するものではなく、油圧シリンダ２１の移動量と歯先隙間Ｗとの関係が得られる所定の位置をいう。

【００３１】図３は、動歯５の下端部５ａをほぼ水平方向に移動させる油圧シリンダ２１を駆動する駆動手段２０の油圧回路図である。同図において、油圧ポンプ２４と１対の油圧シリンダ２１，２１とは電磁切換弁２５を介して接続している。電磁切換弁２５は３位置切換弁であり，そのＡ位置は油圧シリンダ２１の伸張位置に、Ｃ位置は縮小位置に、Ｂ位置は中立位置に相当する。また、電磁切換弁２５の操作ソレノイド部は制御装置３０と接続しており、制御装置３０からの指令信号により電磁切換弁２５は切り換わるようになっている。電磁切換弁２５の出力ポートと油圧シリンダ２１のボトム室とを接続するボトム回路２６上には一方向弁２７が設けられており、油圧シリンダ２１に縮小側の外力が加わっても一方向弁２７によりボトム回路２６は閉じられて油圧シリンダ２１は縮小しないようになっている。ボトム回路２６の一方向弁２７の上流側には接触検出手段２８が設けられ、接触検出手段２８による接触検出信号は制御装置３０に接続している。接触検出手段２８は例えば圧力スイッチ等により構成されており、ボトム回路２６の油圧が所定圧力まで上昇して圧力スイッチがＯＮになると、接触検出信号を制御装置３０に出力する。また、油圧シリンダ２１に取着された位置検出手段２２の検出信号は、制御装置３０に入力されている。

【００３２】制御装置３０からの指令信号により電磁切換弁２５をＡ位置に切り換えると油圧シリンダ２１は伸張し、Ｃ位置にすると油圧シリンダ２１は縮小し、Ｂ位置にすると油圧シリンダ２１は移動を停止する。油圧シリンダ２１を伸張すると歯先隙間Ｗは徐々に小さくなり、固定歯４の下端部４ａと動歯５の下端部５ａとが接触すると油圧シリンダ２１のボトム室の油圧は上昇する。接触検出手段２８は、この油圧上昇により固定歯４と動歯５との接触を検出する。なお、接触検出手段２８は例えば歪みゲージを用いてもよく、あるいは動歯５を固定歯４の方向に移動しているときに位置検出手段２２の検出値が変化しなくなった場合を接触と判定するようにしてもよい。

【００３３】次に、歯先隙間Ｗの算出方法について説明する。歯先隙間Ｗは固定歯４の下端部４ａと動歯５の下

端部５ａとが接触した、すなわち歯先隙間Ｗが零となった時点の動作支点１２の位置を基準として算出して調整する。ここで、動歯５の歯先５ａの位置は、動作支点１２の位置に基づいて、偏心軸７の回転角度、偏心軸７の軸心とトグルプレート１０の前端部１１との距離、及びトグルプレート１０の長さ等を参照して幾何学的に算出可能である。

【００３４】図４は、位置検出手段２２の検出値即ち動作支点１２の位置と歯先隙間Ｗとの関係を表す歯先隙間特性の説明図である。同図の横軸は位置検出手段２２の検出値であり、縦軸は歯先隙間Ｗである。この歯先隙間特性は前述のように幾何学的な位置関係により求められ、制御装置３０のメモリ内に所定距離毎の位置検出値に対応して記憶される。同図において、横軸上の点Ａｏは固定歯４と動歯５とが新品のときにそれぞれの下端部４ａ，５ａが接触したときの位置検出手段２２の検出値であり、この場合には歯先隙間特性ｆｏに基づいて歯先隙間Ｗを算出する。Ａｎは歯先４ａ，５ａが所定量磨耗した後（つまり所定時間稼動後）の固定歯４と動歯５との接触時の位置検出手段２２の検出値であり、この場合には歯先隙間特性をｆｏからｆｎに更新し、更新した歯先隙間特性ｆｎに基づいて歯先隙間Ｗを算出する。Ａｚは固定歯４と動歯５との磨耗限界時の検出値であり、このときの歯先隙間特性はｆｚである。ここで横軸上の点Ａｋは、機械的動作限界位置である。なお、本グラフの実線に示す曲線は上記のように幾何学的に演算して求めたものであるが、細い１点鎖線にて示すように同演算で求めた曲線を近似直線に置き換えてもよい。また、歯先隙間特性ｆｎを位置検出値を変数とした幾何学的関係に基づく所定の関数によって表してもよく、実作動時には位置検出値に応じたこの関数値を演算することにより歯先隙間Ｗを求めてもよい。

【００３５】歯先隙間特性の更新は、図５に示すフローチャート例に従って行われる。同フローチャートにおいて、ステップ４１で制御装置３０は接触検出手段２８からの検出信号を入力し、固定歯４と動歯５とが接触したか否かを判断する。接触した場合にはステップ４２に進み、位置検出手段２２からの位置検出信号Ａｎを入力し、この位置検出信号Ａｎに基づいて新たな歯先隙間特性ｆｎを演算してこの特性に更新し、これ以降は次に固定歯４と動歯５とが接触するまで、新たな歯先隙間特性ｆｎに基づいて歯先隙間Ｗを算出する。ステップ４１で接触してない場合にはステップ４３に進み、そのとき記憶している歯先隙間特性ｆｎ-1に基づいて歯先隙間Ｗを算出する。

【００３６】次に、歯先隙間制御方法について説明する。図６は、第１実施形態の破砕装置の制御構成ブロック図である。駆動手段２０は、前述の図３に示したような油圧シリンダ２１の駆動手段である。歯先隙間表示装置３２は、例えばＬＥＤ表示器やグラフィック表示器等の数値表示器を有しており、この表示器に前記演算された歯先隙間値を表示するものである。摩耗報知装置３３は、固定歯４及び／又は動歯５の摩耗量が所定値以上の磨耗限界に達した場合にこれを作業者等に報知するものであり、例えばグラフィック表示器、キャラクタ表示器及び警報ランプ等の表示手段、ブザー等の音声発生手段、又はこれらの組み合わせによって構成される。そして制御装置３０は、例えば歯先調整手動開始スイッチ、動歯開指令スイッチ及び動歯閉指令スイッチ等よりなる動歯開閉信号入力手段３１と、接触検出手段２８と、位置検出手段２２とに接続されており、これらの手段からの指令信号や検出信号を入力する。また、制御装置３０はこれらの入力信号に基づいて所定の演算処理を行い、演算結果に基づいて、駆動手段２０の電磁切換弁２５に所定の駆動指令を出力し、歯先隙間表示装置３２に表示指令を出力し、さらに摩耗報知装置３３に摩耗限界時の報知指令を出力するようにしている。

【００３７】歯先隙間を調整する場合には、作業者はまず動歯開閉信号入力手段３１の前記歯先調整手動開始スイッチにより歯先調整動作開始指令を手動で制御装置３０に入力する。この後、制御装置３０は自動的に動歯５を閉じる指令を駆動手段２０に出力し、これにより油圧シリンダ２１を伸張して動歯５を固定歯４に向けて移動させ、接触検出手段２８により固定歯４と動歯５との接触を検出すると動歯５の移動を停止する。そして、このときの位置検出手段２２の位置検出信号Ａｎを入力し、この位置検出信号Ａｎに基づいて新たな歯先隙間特性ｆｎを演算してこれまでの歯先隙間特性ｆｎ-1（初期特性はｆｏ）を新たな歯先隙間特性ｆｎに更新する。これ以降、位置検出手段２２の位置検出値の大きさに応じて歯先隙間特性ｆｎに基づいて歯先隙間Ｗを算出し、算出した歯先隙間値を歯先隙間表示装置３２に表示する。なお、上記の動歯閉開始から歯先隙間特性ｆｎの演算及び更新の処理は、制御装置３０が自動的に行う。

【００３８】次に、作業者は歯先隙間表示装置３２に表示された現在の歯先隙間値を見ながら動歯開閉信号入力手段３１の前記動歯開指令スイッチ又は動歯閉指令スイッチにより動歯開信号又は動歯閉信号を手動で制御装置３０に入力して駆動手段２０を介して油圧シリンダ２１を駆動し、動歯５を開方向又は閉方向に移動させる。このとき、動歯開閉信号入力手段３１のインチング操作により微速で移動させ、精度良く位置決め可能となっている。所望の歯先隙間になったら、作業者は動歯開閉信号入力手段３１の操作をオフして移動を停止させる。以上の操作により、作業者は所望の歯先隙間Ｗに精度良く、容易に調整することができる。

【００３９】次に、歯先磨耗報知方法について説明する。作業者は、固定歯４及び動歯５が新品のときに接触検出手段２８により両者の接触を検出した時点の位置検出手段２２の検出値Ａｏを基準として、この検出値Ａｏ

よりも所定の限界摩耗量だけ大きな磨耗限界値Ａｚを予め設定し、制御装置３０内の所定メモリに記憶させておく。この後、制御装置３０は固定歯４と動歯５とを接触させる毎に接触時の位置検出手段２２の検出値が前記設定された磨耗限界値Ａｚに達したら磨耗報知装置３３に警報指令を出力することにより、作業者に磨耗限界に達したことを報知する。また、制御装置３０は前記検出値Ａｏを記憶しておき、この検出値Ａｏと毎回の接触時の検出値Ａｍとの差値即ち磨耗量「Ａｍ－Ａｏ」を算出し、この磨耗量「Ａｍ－Ａｏ」が予め設定された限界磨耗量「Ａｚ－Ａｏ」より大きくなったときに磨耗報知装置３３に警報指令を出力して報知するようにしてもよい。作業者はこの報知を受けて破砕装置１の駆動を停止し、固定歯４及び／又は動歯５を新品と交換するか上下反転する等の所定処置を行うことができる。

【００４０】次に、図７に基づいて第２実施形態を説明する。図７は、本実施形態の破砕装置の制御構成ブロック図である。歯先隙間設定手段３６は、歯先隙間データを数値入力するためのものであり、例えばテンキーやディジタルスイッチ等の数値入力スイッチ、及び書き込みスイッチ等により構成できる。あるいは、通信により設定データ及び設定指令を入力するようにしてもよい。また、歯先隙間調整開始手段３７は、歯先隙間の自動調整を開始させる手段であり、例えば調整開始スイッチで構成してもよいし、通信により調整開始指令を入力するようにしてもよい。制御装置３０は、歯先隙間設定手段３６、歯先隙間調整開始手段３７、接触検出手段２８及び位置検出手段２２からの数値データ、指令信号及び検出信号等を入力し、これらのデータ及び信号に基づいて所定の処理を行う。そして、この処理結果に応じて、駆動手段２０及び歯先隙間表示装置３２にそれぞれ所定の指令信号を出力するようになっている。

【００４１】歯先隙間を調整する場合には、作業者はまず歯先隙間設定手段３６により所望の歯先隙間データを制御装置３０に入力し記憶させる。次に、作業者は歯先隙間調整開始手段３７により歯先隙間の調整開始信号を制御装置３０に入力する。調整開始信号を入力した制御装置３０は、以下の動作を自動的に行う。まず、駆動手段２０に指令信号を出力して油圧シリンダ２１を伸張し、動歯５を固定歯４に向けて移動させる。接触検出手段２８が固定歯４と動歯５との接触を検出すると、油圧シリンダ２１の伸張を停止し、同時にそのときの位置検出手段２２の検出値を基準にして歯先隙間特性を更新する。次に、実際の歯先隙間が前記入力された所望の歯先隙間データと等しくなるような動作支点１２の目標位置を、前記更新した歯先隙間特性に基づいて算出し、実際の動作支点１２がこの目標位置になるように油圧シリンダ２１に縮小指令信号を出力し、位置検出手段２２の検出値がこの目標位置に等しくなったら油圧シリンダの作動を停止する。以上の動作により、設定された歯先隙間に自動的に調整されるので、調整作業が非常に容易となる。また、作業現場の被破砕対象物の種類及び用途に応じた歯先隙間に設定できるので、本破砕装置を汎用的に使用できるようになる。

【００４２】次に、第３実施形態を説明する。図８は、本実施形態の破砕装置の正面断面図である。同図において、図１と同一の構成要素には同一の符号を付し、ここでの説明を省く。破砕作業中にジョークラッシャー２に過負荷が加わり、動作支点１２が予め定められたずれの許容限界範囲を越えてずれた場合、歯先隙間Ｗが大きくなって製品品質が低下する（つまり粒度が大きくなる）という問題が発生する。また、動作支点１２のずれが機械的動作限界位置に達してなお過大な外力が加わると、破砕装置が損傷する可能性がある。さらに、歯先隙間Ｗが過少になりすぎると、動歯５の揺動時に固定歯４と動歯５とが干渉し、装置破損の原因となることもある。これらを防止するために、本発明の破砕装置は過負荷防止機能及び干渉防止機能を有している。

【００４３】油圧シリンダ２１を縮小すると、トグルブロック１３は所定位置で下部フレーム８に当接する構造になっている。この当接位置はトグルブロック１３の機械的動作限界位置であり、トグルブロック１３がこの機械的動作限界位置から所定距離だけ離れた所定位置に到達したことを検出する動作限検出手段２３が下部フレーム８とトグルブロック１３との間に設けられている。動作限検出手段２３は、例えばリミットスイッチや近接スイッチ等の位置検出器で構成される。尚、位置検出手段２２にて動作限検出手段２３を兼ねてもよい。

【００４４】図９は、本実施形態の破砕装置の制御構成ブロック図である。制御装置３０は、接触検出手段２８、位置検出手段２２及び動作限検出手段２３に接続されており、それぞれの検出信号を入力する。また、制御装置３０はこれらの検出信号に基づいて所定の演算処理を行い、この演算結果に基づいてジョークラッシャー２の偏心軸７を回転駆動する油圧モータ等の偏心軸駆動手段３４、及び供給装置９を駆動する油圧モータ等の供給装置駆動手段３５にそれぞれの駆動指令信号を出力する。

【００４５】次に、上記構成による作動について説明する。作業者は、予め、品質保証のための動作支点ずれの許容限界Ｌ、動作限検出手段２３により検出する動作限位置、及び固定歯４と動歯５との干渉を防止するための動歯５の移動禁止領域を設定し、制御装置３０に記憶させておく。図１０はこれらの各設定位置の説明図であり、同図の横軸は位置検出手段２２の検出位置を表している。基準位置Ｂｏは、ある隙間調整のときに、固定歯４と動歯５とが接触している時の動作支点１２の検出位置であり、位置Ｂｎは所望の歯先隙間Ｗに調整したときの動作支点１２の検出位置である。位置Ｂｎから所定距離Ｌ（Ｌは、ずれの許容限界値）の位置に品質保証上必

要なずれの許容限界位置Ｂｓを設定する。位置Ａｋは機械的動作限界位置であり、位置Ａｋより所定距離Ｍだけ手前の位置に動作限検出手段２３により検出される動作限位置Ａｍを設定する。基準位置Ｂｏから所定距離Ｎだけ動歯５の開側に離れた位置Ｂｐを設定し、基準位置Ｂｏと位置Ｂｐとの間を固形歯４と動歯５との干渉のおそれがある移動禁止領域としている。尚、位置Ａｚは、固定歯４と動歯５とを接触させた時の動作支点１２がこの位置Ａｚに来たときは磨耗限界とみなす位置である。

【００４６】制御装置３０は、前回、動歯５の動作支点１２を移動させて歯先隙間調整を行い、動作支点１２の位置を決めたときの位置検出手段２２の検出位置Ｂｎを記憶しておく。この後、制御装置３０は前記検出位置Ｂｎと、破砕作業中の位置検出手段２２の検出位置Ｂとに基づいて両位置間の距離、即ち「Ｂｎ－Ｂ」の絶対値を演算し、両位置間の距離がずれの許容限界値Ｌ以上になったとき、偏心軸駆動手段３４及び供給装置駆動手段３５に作動停止信号を出力して作動を停止させ、不良品の発生を防止する。また、上記両位置間の距離がずれの許容限界値Ｌよりも小さいときでも、破砕作業中の検出位置Ｂが動作限位置Ａｍを越えて機械的動作限界位置Ａｋに接近したら、即ち動作限検出手段２３が検出した場合には、制御装置３０は偏心軸駆動手段３４及び供給装置駆動手段３５の作動を停止させ、これにより機械の損傷を防止する。さらに、制御装置３０は、直前の隙間調整の際に固定歯４と動歯５とが接触したときの位置検出手段２２の検出位置を基準位置Ｂｏとして記憶し、歯先隙間調整後の破砕中に位置検出手段２２の検出位置Ｂと前記基準位置Ｂｏとの距離、即ち「Ｂｏ－Ｂ」の絶対値を演算する。そして、両位置間の距離が所定距離Ｎ以下になったときには、検出位置Ｂが固定歯４近傍の移動禁止領域に達したと判断し、偏心軸駆動手段３４及び供給装置駆動手段３５の作動を停止して固定歯４と動歯５との干渉を防止し、これにより破砕装置の破損を未然に防止できる。

【００４７】以上のような構成の破砕装置を移動自在な車両上に搭載した、いわゆる自走式破砕機の場合、複数台の自走式破砕機を直列に配設して破砕物を順次細かく破砕する作業を行う場合がある。図１１は、２台の自走式破砕機５０ａ，５０ｂを直列に配設した適用例を示している。２台の自走式破砕機５０ａ，５０ｂの各下部走行体５１ａ，５１ｂには、それぞれジョークラッシャー２ａ，２ｂと供給装置９ａ，９ｂとからなる破砕装置１ａ、１ｂが搭載されている。各ジョークラッシャー２ａ，２ｂの下方には、破砕物を外部に搬出する破砕物搬送装置５２ａ，５２ｂがそれぞれ設けられている。下流側の自走式破砕機５０ｂは上流側の自走式破砕機５０ａの破砕物搬送装置５２ａから供給装置９ｂに破砕物の供給を受け、ジョークラッシャー２ｂによりさらに細かく破砕（２次破砕）を行う。このような直列適用の場合に、下流側の破砕装置に前述したような問題が発生して、供給装置９ｂ及びジョークラッシャー２ｂの作動を停止しても、破砕物は上流側の自走式破砕機５０ａの破砕物搬送装置５２ａにより供給され続ける。そのため、下流側の自走式破砕機５０ｂの供給装置９ｂ及びジョークラッシャー２ｂは破砕物が充満し、再起動する場合にはつまった破砕物を人力で除去しなければならず、多大の労力と時間とを必要とする。

【００４８】上記問題を解決するために、本発明に係る破砕装置の歯先隙間調整装置の制御装置は、下流側の自走式破砕機５０ｂの供給装置９ｂ及び／又はジョークラッシャー２ｂを作動停止すると同時に、上流側の自走式破砕装置５０ａの少なくとも供給装置９ａの作動を停止させるインタロック機能を有するものである。図１２は、上流側破砕機と下流側破砕機との間のインタロック機能の構成ブロック図である。下流側の自走式破砕機５０ｂの制御装置３０ｂは無線発信機よりなる第１外部出力部５３を有しており、上流側の自走式破砕機５０ａの制御装置３０ａは無線受信機５５を有している。下流側の自走式破砕機５０ｂの供給装置９ｂ及び／又はジョークラッシャー２ｂを停止する場合には、第１外部出力部５３から無線で上流側の自走式破砕機５０ａに停止指令信号を出力し、上流側の無線受信機５５はこれを受信して制御装置３０ａに入力し、制御装置３０ａは少なくとも供給装置９ａの作動を停止させるようにしている。このインタロック信号により、下流側の自走式破砕機５０ｂが停止中でも、自走式破砕機５０ｂには多量の破砕物が供給されることはなく、したがって再起動時に作業者が余分な破砕物を除去する必要はなく、容易に再起動を行うことができる。なお、無線によるインタロックなので、両自走式破砕機の移動、配置等は影響を受けずに自在に行える。また、下流側の自走式破砕機５０ｂの制御装置３０ｂは第２外部出力部５４を有していてもよい。第２外部出力部５４はリレー又は電子回路（トランジスタやロジックＩＣ等の回路）による出力回路で構成され、有線で上流側の自走式破砕機５０ａの制御装置３０ａに接続されている。この場合の作用及び効果は、上記無線によるインタロックとほぼ同一であるが、無線機を使用するよりも安価なコストで製造できる。

【００４９】以上説明したように、本発明によれば以下の効果が得られる。

（１）固定歯と動歯が当接した位置を基準として歯先隙間を求めているので、機械原点位置からの距離に基づく演算は不要となり、簡単な演算でジョークラッシャーの正確な歯先隙間を算出できる。したがって、制御装置のＣＰＵ等の演算処理装置の演算負荷を軽減できるので、コスト低減及び軽量小型化ができる。

（２）また、機械原点位置からの距離に基づく演算が不要となったため、修理や保守点検時に機械原点位置を正確に設定する必要がなくなる。これにより、機械原点設

定作業も簡単に、短時間で行え、作業者の労力を大幅に軽減できる。

（３）さらに、被破砕物の種類や用途に応じた歯先隙間設定を容易に行うことができるので、高い品質の製品、即ち所望の粒度の破砕物をバラツキなく得ることができる。これにより、適用範囲が広く、汎用性の高い破砕装置が得られる。

（４）また、歯先隙間を精度良く測定できるので、固定歯及び動歯の摩耗度も正確に測定でき、よって磨耗時の歯先交換を適切な時期に有効に行うことができる。したがって、歯先の交換部品を無駄無く、しかも製品の精度を劣化させずに使用できると共に、保守作業回数を低減できる。

（５）歯先隙間調整後、動歯の動作支点の位置を常時監視していて、破砕中に過負荷が加わり、動歯がずれの許容限界範囲を越えたとき、機械原点近傍の動作限位置を越えたとき、又は固定歯近傍の移動禁止領域内に入ったときには、動歯の作動及び供給装置を停止するようにしたので、人的判断のミスにより発生し易い破砕装置の破損を確実に未然に防止できる。

（６）被破砕物の種類や破砕物の用途に応じて、複数個の破砕装置を直列に配設して使用する場合に、下流側の破砕装置の破砕停止時に上流側の破砕装置の少なくとも供給装置を停止し、又はこれに加えてジョークラッシャーを停止するようにしたので、破砕物が下流側の破砕装置に多量に溜まることがなくなり、作業の再開始を容易に行うことができる。さらに、上流側の破砕装置の少なくとも供給装置を停止するので、下流側の破砕装置の停止に伴なって上流側の破砕装置のジョークラッシャーに被破砕物が多量に貯まることによる上流側の破砕装置の故障の発生を未然に防止できる。

【図面の簡単な説明】

【図１】本発明の第１実施形態の破砕装置の正面断面図である。

【図２】図１のＡ－Ａ矢視図である。

【図３】本発明の駆動手段の油圧回路図である。

【図４】位置検出手段の検出値と歯先隙間との関係を表す歯先隙間特性の説明図である。

【図５】歯先隙間特性の更新のフローチャート例である。

【図６】第１実施形態の制御構成ブロック図である。

【図７】第２実施形態の制御構成ブロック図である。

【図８】第３実施形態の破砕装置の正面断面図である。

【図９】第３実施形態の制御構成ブロック図である。

【図１０】過負荷防止機能に係る各設定位置の説明図である。

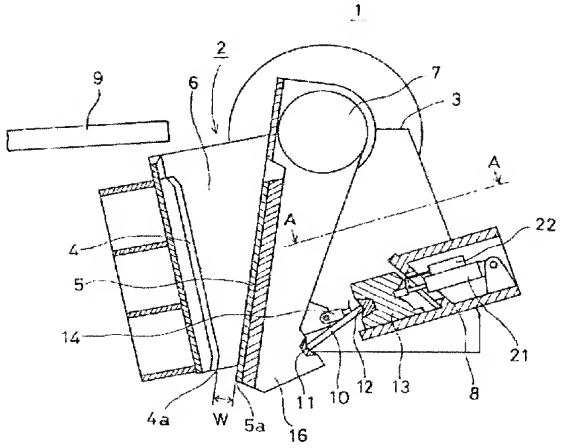
【図１１】自走式破砕機の直列配置での作業への適用例の説明図である。

【図１２】上流側破砕機と下流側破砕機との間のインタロック機能の構成ブロック図である。

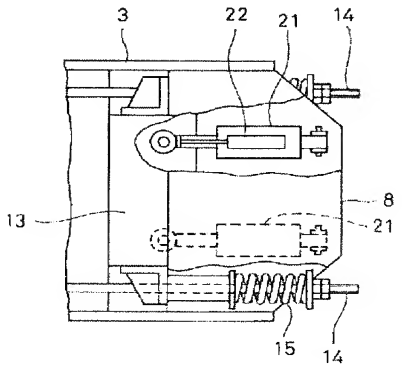
【符号の説明】

１：破砕装置、２：ジョークラッシャー、３：フレーム、４：固定歯、４ａ，５ａ：歯先、５：動歯、８：下部フレーム、９：供給装置、１０：トグルプレート、１２：動作支点、１３：トグルブロック、２０：駆動手段、２１：油圧シリンダ、２２：位置検出手段、２３：動作限検出手段、２８：接触検出手段、３０：制御装置、３１：動歯開閉信号入力手段、３２：歯先隙間表示装置、３３：磨耗警報装置、３４：偏心軸駆動手段、３５：供給装置駆動手段、３６：歯先隙間設定手段、３７：歯先隙間調整開始手段、５０，５０ａ，５０ｂ：自走式破砕機、５２ａ，５２ｂ：破砕物搬送装置、５３：第１外部出力部、５４：第２外部出力部。

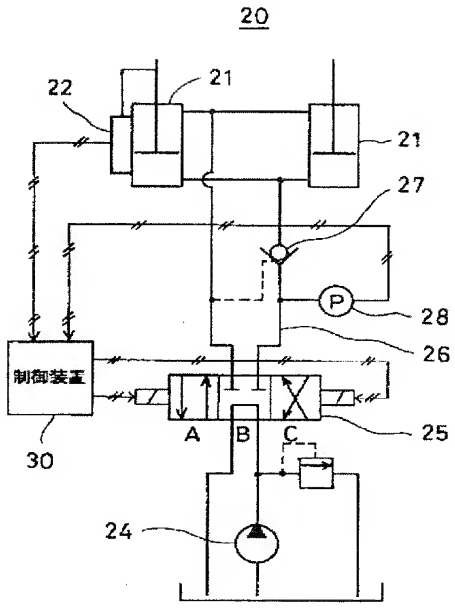
【図１】



【図２】



【図３】



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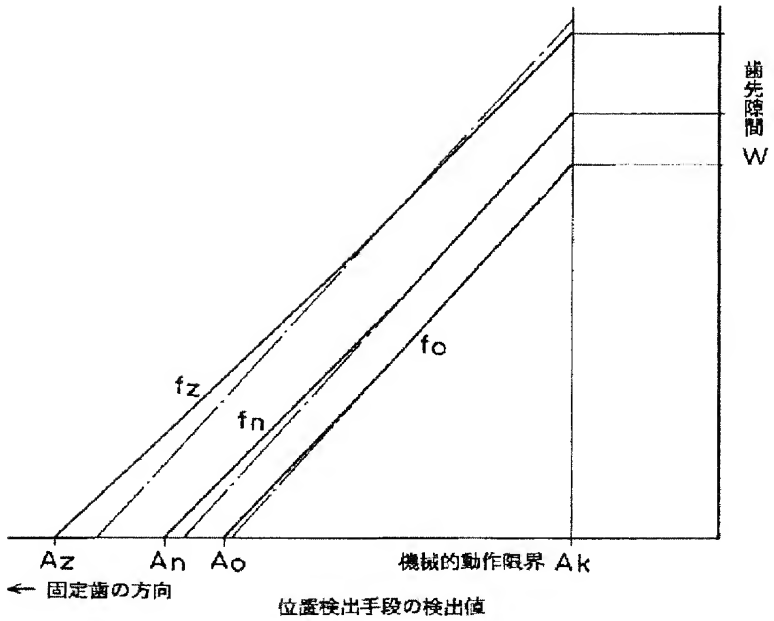

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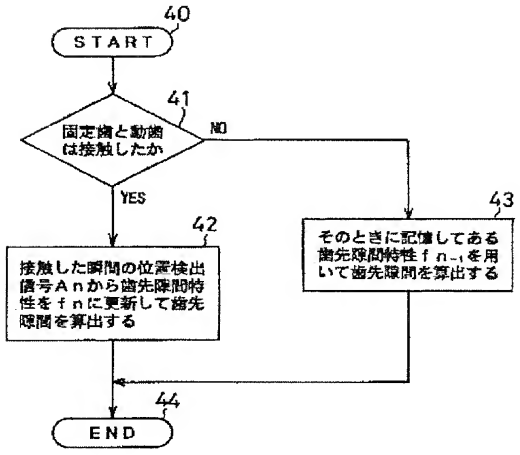

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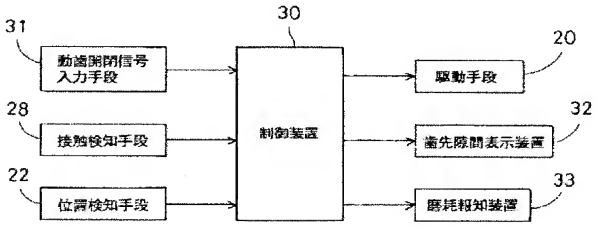

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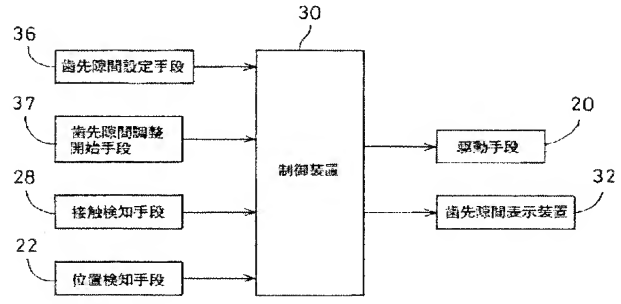

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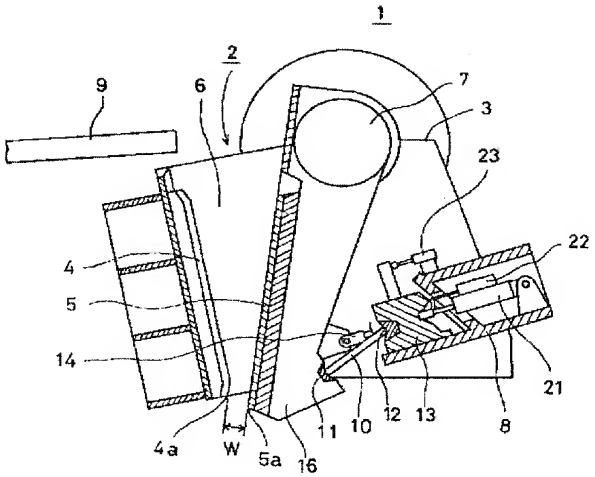
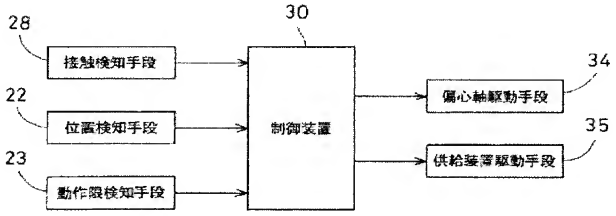
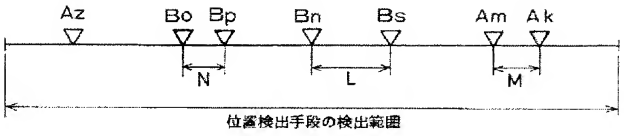


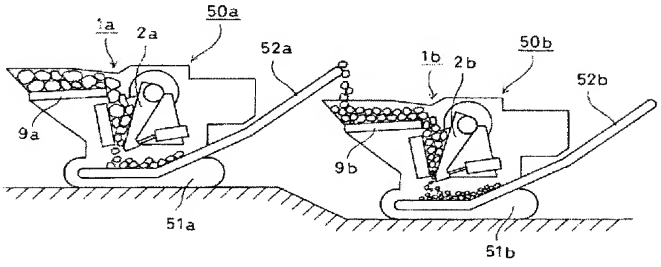
【図９】



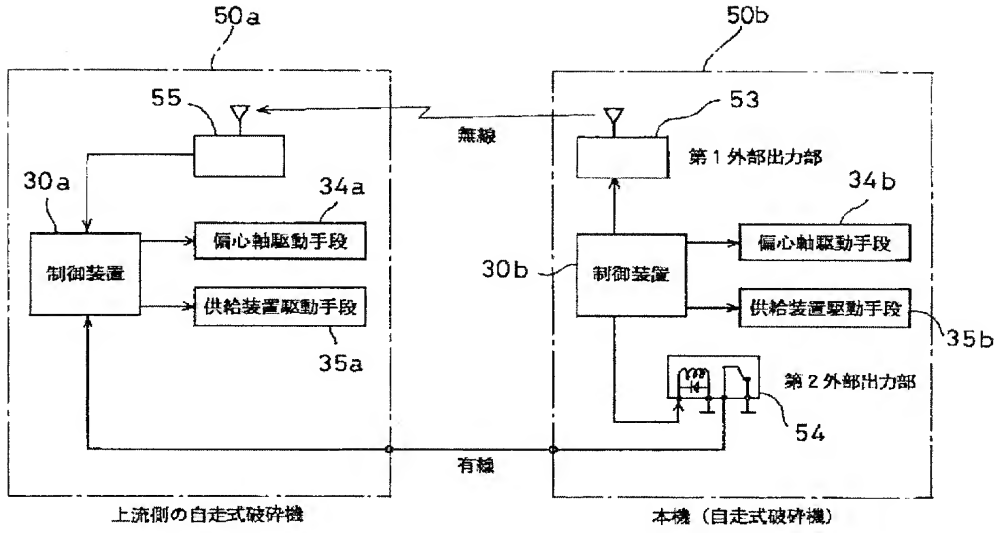
【図１０】



【図１１】



【図１２】



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